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MONTHLY WEATHER REVIEW

CLEVELAND ABBE, Jr., Acting Editor.

VOL. 43, No. 7.
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INTRODUCTION.

As explained in this Introduction during 1914, the MONTHLY WEATHER REVIEW now takes the place of the Bulletin of the Mount Weather Observatory and of the voluminous publication of the climatological service of the Weather Bureau. The MONTHLY WEATHER REVIEW contains contributions from the research staff of the Weather Bureau and also special contributions of a general character in any branch of meteorology and climatology.

SUPPLEMENTS to the MONTHLY WEATHER REVIEW will be published from time to time.

The climatological service of the Weather Bureau is maintained in all its essential features, but its publications, so far as they relate to purely local conditions, are incorporated in the monthly reports "Climatological Data" for the respective States, Territories, and colonies.

Since December, 1914, the material for the MONTHLY WEATHER REVIEW has been prepared and classified in accordance with the following sections:

SECTION 1.—*Aerology.*—Data and discussions relative to the free atmosphere.

SECTION 2.—*General meteorology.*—Special contributions by any competent student bearing on any branch of meteorology and climatology, theoretical or otherwise.

SECTION 3.—*Forecasts and general conditions of the atmosphere.*

SECTION 4.—*Rivers and floods.*

SECTION 5.—*Seismology.*—Results of observations by Weather Bureau observers and others as reported to the Washington office. Occasional original papers by prominent students of seismological phenomena.

SECTION 6.—*Bibliography.*—Recent additions to the Weather Bureau library; recent papers bearing on meteorology.

SECTION 7.—*Weather of the month.*—Summary of local weather conditions; climatological data from regular Weather Bureau stations; tables of accumulated and excessive precipitation; data furnished by the Canadian Meteorological Service; monthly charts Nos. 1, 2, 3, 4, 5, 6, 7, 8, the same as hitherto.

In general, appropriate officials prepare the seven sections above enumerated; but all students of atmospherics are cordialty invited to contribute such additional articles as seem to be of value.

The voluminous tables of data and text, relative to local climatological conditions that during recent years were prepared by the 12 respective "district editors," are omitted from the MONTHLY WEATHER REVIEW, but collected and published by States at selected section centers.

The data needed in Section 7 can only be collected and prepared several weeks after the close of the month whose name appears on the title page; hence, the REVIEW as a whole can only issue from the press within about eight weeks from the end of that month.

It is hoped that the meteorological data hitherto contributed by numerous independent services will continue as in the past. Our thanks are especially due to the directors and superintendents of the following:

The Meteorological Service of the Dominion of Canada.
The Meteorological Service of Cuba.
The Meteorological Observatory of Belen College, Habana.
The Government Meteorological Office of Jamaica.
The Meteorological Service of the Azores.
The Meteorological Office, London.
The Danish Meteorological Institute.
The Physical Central Observatory, Petrograd.
The Philippine Weather Bureau.

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SECTION I.—AEROLOGY.

SOLAR AND SKY RADIATION MEASURED AT WASHINGTON, D. C., DURING JULY, 1915.

By HERBERT H. KIMBALL, Professor of Meteorology.

[Dated: Washington, D. C., Aug. 4, 1915.]

In Table 1 are summarized the measurements of the intensity of direct solar radiation made by the Weather Bureau at the American University,[1] Washington, D. C., during July, 1915. The means for the month are considerably lower than the 5-year means published in the Bulletin of the Mount Weather Observatory, 1912, **5**:182, Table 3. On the 6th, 9th, and 18th, intensities very nearly in accord with these means were measured.

Skylight polarization, measured at solar distance 90° and in his vertical, with the sun at zenith distance 60°, averaged 45 per cent, with a maximum of 57 per cent on the 6th. This latter is the average maximum polarization for July for Washington, as published in the Bulletin of the Mount Weather Observatory, 1910, **3**:114, Table 16.

In Table 2, column 2 gives the daily totals of solar and sky radiation received on a horizontal surface at the American University. The measurements were made with a Callendar recording pyrheliometer as described in the REVIEW for March, 1915, **43**:100. Table 2, column 3, gives the daily departures from the normals published in the same number of the REVIEW, page 109, Table 4.

The "Percentage of possible sunshine" and the "Average cloudiness," given in columns 5 and 6 of Table 2, have been taken from the records of the observatory at the central office of the Weather Bureau.

While the above data show about the average number of hours of sunshine for July, the total radiation was below the average. The deficiency occurred in the second decade, however, as both the first and third decades show slightly more than the average amount of radiation.

TABLE 1.—*Solar radiation intensities at Washington, D. C., during July, 1915.*

[Gram-calories per minute per square centimeter of normal surface.]

Date.	Sun's zenith distance.										
	0.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.3°	79.8°	80.7°
	Air mass.										
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
1915. A. M.	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*
July 6	1.39	1.23	1.11	1.03	0.95	0.88	0.81	0.74	0.66	.....	.....
9	1.36	1.27	1.16	1.07	1.00	.....	.....	.....	.....	.....	.....
17	.....	1.04	0.78	0.74	.....	.....	.....	.....	.....	.....	.....
18	1.35	1.17	1.04	0.94	.....	.....	.....	.....	.....	.....	.....
19	0.99	0.82	0.72	0.64	0.56	.....	.....	.....	.....	.....	.....
21	.....	1.01	0.84	0.77	.....	.....	.....	.....	.....	.....	.....
22	.....	1.03	0.89	0.76	0.66	0.57	0.50	0.45	0.42	.....	.....
24	1.16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	1.08	0.95	0.86	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	0.73	.....	.....	.....	.....	.....	.....	.....	.....
Means	**1.22**	**1.06**	**0.90**	**0.85**	**0.79**	**(0.72)**	**(0.66)**	**(0.60)**	**(0.54)**	.....	.....
P. M.											
July 6	.....	1.25	1.12	1.02	0.95	0.89	0.77	.....	.....	.....	.....
24	.....	1.05	0.91	0.82	.....	.....	.....	.....	.....	.....	.....
Means	.....	**(1.15)**	**(1.02)**	**(0.92)**	**(0.95)**	**(0.89)**	**(0.77)**	.....	.....	.....	.....

[1] For a description of exposures of instruments and details of methods of observation, see this REVIEW, December, 1914, **42**: 648.

TABLE 2.—*Daily totals and departures of solar and sky radiation at Washington, D. C., during July, 1915.*

[Gram-calories per square centimeter of horizontal surface.]

Day of month.	Daily total.	Departure from normal.	Excess or deficiency since first of month.	Percentage of possible sunshine.	Average cloudiness.
	Gr.-cal.	*Gr.-cal.*	*Gr.-cal.*	*Per cent.*	*0–10.*
July 1	592	68	68	78	4
2	547	22	90	70	6
3	430	− 95	− 5	60	8
4	458	− 67	− 72	43	9
5	372	−153	− 225	39	8
6	767	242	17	100	0
7	581	57	74	77	6
8	367	−157	− 83	43	7
9	758	235	152	100	1
10	534	12	164	64	8
11	337	−185	− 21	22	9
12	481	− 40	− 61	52	7
13	594	74	13	73	5
14	640	120	133	90	5
15	356	−163	− 30	24	9
16	366	−152	− 182	38	8
17	439	− 78	− 260	54	5
18	655	139	− 121	99	0
19	415	− 99	− 220	60	5
20	241	−272	− 492	0	10
Decade departure			− 656		
July 21	528	17	− 475	61	4
22	580	70	− 405	79	4
23	563	55	− 350	56	4
24	632	126	− 224	99	3
25	629	124	− 100	98	0
26	562	59	− 41	96	3
27	518	17	− 24	96	5
28	372	−127	− 151	43	9
29	448	− 49	− 200	36	8
30	498	3	− 197	65	5
31	549	55	− 142	82	4
Decade departure			350		
Total excess or deficiency since first of year			−1,200		

NOTE ON THE DISTRIBUTION OF MOISTURE IN THE ATMOSPHERE.

By WM. R. BLAIR, Professor in Charge of Aerological Investigations.

[Dated: Weather Bureau, Washington, Aug. 3, 1915.]

In the Bulletin of the Mount Weather Observatory, volume 4, part 4, pages 194–197, the writer published tables of the absolute humidity, in grams per cubic meter, at different levels above sea. The weights are given to thousandths of a gram in these tables. The following statement is made on page 209 of the same volume: "It seems plausible that * * * the constituent, water vapor, will remain an important factor even at very high levels, etc." Since the publication of the above, inquiries have been received as to whether the accuracy of the observations, made in free balloon ascensions, justified the use of three decimal places in these tables. In answer to these inquiries it may be stated that the best proof we had at the time of the accuracy of the observations of relative humidity was the fact that, among themselves, the results of these observations are consistent. This evidence pointed to the fact that the weights obtained were qualitatively correct and were valuable in expressing the relative moisture content of the air at different levels or at different times. The expression of these relative values required the use of three decimal places in the tables. The use of at least three decimal places is also justified by the fact that at the higher levels

reached the weight per cubic meter of dry air is comparatively small. When one is considering the depth of water that would result from the precipitation of all the atmospheric moisture above a given area of the earth's surface, it is usually true that the consideration of the moisture found in the higher levels has very little effect on the result. This point of view is useful when the absorption by the water vapor of the air of outgoing or incoming radiation is the subject of study. If one is thinking of the relative amounts by weight of water vapor and dry air at a given level and of the possible effect of this relation on the distribution of air temperature and on other atmospheric phenomena, the moisture found in the higher levels seems to assume very considerable importance. Table 1, based upon the results obtained in six summer and six winter balloon observations, gives some idea of this importance. The six summer ascensions used are those of September 1, 5, and 11, 1910, and July 23, 27, and 30, 1913. The six winter ascensions are those of February 9, 14, 15, 18, 25, and 26, 1911. The 1910 group of three ascensions were made at Huron, S. Dak., the 1913 group of three were made at Avalon, Santa Catalina Island, Cal.; the 1911 group of six were made at Fort Omaha, Nebr. This table shows the ratio of the weight of water to the weight of dry air at the different levels selected for computation. In getting the mean ratio for the six summer and the six winter observations, arithmetic means of the air temperature, air pressure, vapor pressure, and weight in grams per cubic meter of the air moisture were found for each level. Based upon the first three means the weight per cubic meter of dry air at a given level was determined. Comparison was then made between this weight and the third mean found above. The ratio has been determined for several of the ascensions separately. Of these the determinations for September 1, 1910, and for September 11, 1910, are tabulated as showing the extreme values of the ratio found in the upper levels.

TABLE I.—*Showing variation of the ratio,* $\frac{\text{Weight of } H_2O}{\text{Weight of dry air}} \times 10^6$, *with altitude.*

Altitude in kilometers	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	11
Means of observations made Sept. 1, 5, 11, 1910, and July 23, 27, 30, 1913	8,535	8,328	7,522	6,693	4,665	3,278	2,255	1,754	1,386	1,134	775	49	280	181	93	60
Means of observations made Feb. 9, 14, 15, 18, 25, 26, 1911	2,547	2,107	1,991	1,491	1,036	855	677	624	569	534	348	160	103	56	39	31
Observation of Sept. 1, 1910 (air of upper levels extremely dry)	11,268	11,600	10,524	8,373	4,983	2,085	742	351	207	214	164	106	61	36	14	8
Observation of Sept. 11, 1910 (air of upper levels extremely moist)	4,484	4,133	6,837	7,874	5,654	4,303	3,305	2,897	2,480	2,134	2,081	1,561	960	666	323	190

Altitude in kilometers	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Means of observations made Sept. 1, 5, 11, 1910, and July 23, 27, 30, 1913	49	35	41	48	50	51	75	106	124	196	285	542	1,039	1,697	.....	.....
Means of observations made Feb. 9, 14, 15, 18, 25, 26, 1911	33	42	44	42	42	48	49	57	78	92	[1] 137	[1] 142	[1] 164	.....	.....	.....
Observation of Sept. 1, 1910 (air of upper levels extremely dry)	3	3	4	5	6	13	15	18	21	37	43	51	59	70	83	97
Observation of Sept. 11, 1910 (air of upper levels extremely moist)	120	80	137	195	233	216	363	521	659	911	1,442	2,808	5,712	9,553	.....	.....

[1] Observation of Feb. 25, 1911, only.

Sounding-balloon observations to a height of 25 or more kilometers are comparatively few in number either in this country or elsewhere. The indications of available data obtained in other countries are found to be similar to those of the data contained in Table 1.

It happened that during three observations of the 1913 series at Avalon, Mr. Fowle, of the Smithsonian Institution, was simultaneously observing spectroscopically the total amount of precipitable water in the atmosphere above Mount Wilson. The comparison of hygrometric and spectroscopic determinations of this depth is of especial interest here as indicating that the hygrometric determinations are of value in a quantitative as well as in a qualitative sense. The comparison is made in Table 2.

Table 1 indicates a minimum value for the ratio under consideration somewhere between the 10 and 15 kilometer levels for the observations considered. Above these levels the ratio may become greater than was found at any lower level.

In addition to answering questions that have arisen, it is thought that the facts of observation shown in Table 1 may be of interest in connection with the theory that has given rise to the terms "troposphere" and "stratosphere" for lower and upper regions of the atmosphere, which have been supposed to be so distinctly separated from each other that there is practically no mixing across the boundary plane between them of the air in one with the air in the other. This boundary plane has been placed at the supposed upper limit of convection, and consequently at the upper limit of a homogeneous mixture of the constituent gases of the atmosphere, and at the lower limit of a region in which there is no convection and in which constituent gases sort themselves under the influence of gravity. According to this theory, any moisture found in the stratosphere must have reached it by diffusion across the boundary plane from the supposedly moister air of the troposphere, and its quantity must therefore be small. On this supposition some relation should be found to exist between the vapor pressures in the two regions considered. It is not at all clear from the data that any such relation exists. Indeed these data point rather to the distribution of moisture in the usual way throughout the region explored; i. e., both by air movement and by diffusion.

TABLE 2.

Date.	Balloon H_2O.	Spectroscopic H_2O.
	cm.	cm.
July 23, 1913	1.07	1.17
Aug. 3, 1913	1.41	1.39
Aug. 8, 1913	2.09	2.06

TABLES OF SUN-SPOT FREQUENCIES, 1901-1914.

Prof. A. WOLFER, Zurich.

The reader will find the first complete and revised series of both the observed and the smoothed Wolf-Wolfer relative sun-spot numbers in the MONTHLY WEATHER REVIEW, April, 1902, in Tables 1 and 2, on pages 173 and 176. On page 171 of that issue the significance of these numbers is explained by Prof. Wolfer as follows:

The *smoothed relattve numbers* of Table 2 present the mean course of the spot phenomena; that is to say, without the numerous secondary short-period variations that really occur in addition to the 11-year variation. Investigations into the general course of the phenomena and into other periods should therefore be based upon these "*smoothed numbers*" and not on the "observed numbers." The method of formation of these numbers has been explained by Wolf in No. 42 of his Astronomische Mitteilungen.

It is also explained in the issue of the REVIEW mentioned, and the significance of his "relative numbers" is given in the REVIEW for November, 1901, page 505.

Prof. Wolfer has just published in the Meteorologische Zeitschrift for May, 1915, pages 193–195, the latest values for both the "observed" and the "smoothed" relative numbers, and has added to these Table 3, showing the epochs of sun-spot maxima and minima with the intervening periods. These three tables are here reprinted as in continuation of the tables published in the REVIEW of April, 1902.[1]—[C. A. jr.]

TABLE 1.—*Observed relative sun-spot numbers, Wolf-Wolfer system, 1901–1914.*

Year.	Jan. I.	Feb. II.	Mar. III.	Apr. IV.	May V.	June VI.	July VII.	Aug. VIII.	Sept. IX.	Oct. X.	Nov. XI.	Dec. XII.	Average.
1901...	0.2	2.4	4.5	0.0	10.2	5.8	0.7	1.0	0.6	3.7	3.8	0.0	2.7
1902...	5.2	0.0	12.4	0.0	2.8	1.4	0.9	2.3	7.6	16.3	10.3	1.1	5.0
1903...	8.3	17.0	13.5	26.1	14.6	16.3	27.9	28.8	11.1	38.9	44.5	45.6	24.4
1904...	31.6	24.5	37.2	43.0	39.5	41.9	50.6	58.2	30.1	54.2	38.0	54.6	42.0
1905...	54.8	85.8	56.5	39.3	48.0	49.0	73.0	58.8	55.0	78.7	107.2	55.5	63.5
1906...	45.5	31.3	64.5	55.3	57.7	63.2	103.3	47.7	56.1	17.8	38.9	64.7	53.8
1907...	76.4	108.2	60.7	52.6	43.0	40.4	49.7	54.3	85.0	65.4	61.5	47.3	62.0
1908...	39.2	33.9	28.7	57.6	40.8	48.1	39.5	90.5	86.9	32.3	45.5	39.5	48.5
1909...	56.7	46.6	66.3	32.3	36.0	22.6	35.8	23.1	38.8	58.4	55.8	54.2	43.9
1910...	26.4	31.5	21.4	8.4	22.2	12.3	14.1	11.5	26.2	38.3	4.9	5.8	18.6
1911...	3.4	9.0	7.8	16.5	9.0	2.2	3.5	4.0	4.0	2.6	4.2	2.2	5.7
1912...	0.3	0.0	4.9	4.5	4.4	4.1	3.0	0.3	9.5	4.6	1.1	6.4	3.6
1913...	2.3	2.9	0.5	0.9	0.0	0.0	1.7	0.2	1.2	3.1	0.7	3.8	1.4
1914...	2.5	2.6	3.1	17.3	5.3	11.4	5.4	7.8	12.8	8.1	16.1	22.2	9.6

TABLE 2.—*Smoothed relative sun-spot numbers, Wolf-Wolfer system, 1901–1914.*

Year.	Jan. I.	Feb. II.	Mar. III.	Apr. IV.	May V.	June VI.	July VII.	Aug. VIII.	Sept. IX.	Oct. X.	Nov. XI.	Dec. XII.	Average.
1901...	4.8	4.4	3.9	3.2	2.8	2.8	3.0	3.1	3.3	3.6	3.3	2.8	3.4
1902...	2.6	2.7	3.1	3.9	4.7	5.0	5.2	6.0	6.8	7.9	9.5	10.6	5.7
1903...	12.3	14.6	15.8	16.9	19.3	22.5	25.4	26.6	27.9	29.6	31.4	33.5	23.0
1904...	35.5	37.7	39.7	41.1	41.5	41.6	42.9	46.4	49.8	50.5	50.7	51.3	44.1
1905...	52.5	53.5	54.6	56.6	60.5	63.4	63.1	60.4	58.5	59.5	60.6	61.6	58.7
1906...	63.4	64.2	63.8	61.3	55.9	53.5	55.1	59.6	62.7	62.4	61.7	60.1	60.3
1907...	56.9	55.0	56.4	59.6	62.6	62.8	60.5	55.9	51.4	50.3	50.4	50.6	56.0
1908...	50.5	51.6	53.2	51.9	49.9	48.9	49.3	50.5	52.6	53.1	51.9	50.6	51.2
1909...	49.4	46.4	41.6	40.7	42.2	43.3	42.6	40.7	38.2	35.4	33.8	32.8	40.6
1910...	31.5	30.1	29.1	27.7	24.7	20.6	17.6	15.7	14.2	14.0	13.8	12.8	21.0
1911...	12.0	11.2	10.0	7.6	6.0	5.9	5.6	5.1	4.6	4.0	3.3	3.2	6.5
1912...	3.2	3.0	3.1	3.4	3.4	3.4	3.7	3.9	3.8	3.5	3.2	2.8	3.4
1913...	2.6	2.5	2.2	1.8	1.7	1.5	1.4	1.4	1.5	2.3	3.2	3.9	2.2
1914...	4.6	5.0	5.8	6.5	7.4	8.8	.....	.....	.....	.....	.....	.....	.....

[1] The present tables extend the records published in Bull., Mount Weather Observatory, 5, pt. 6, 1913, p. 368.

TABLE 3.—*Epochs of sunspot maxima and minima.*

Minima.			Maxima.		
Epochs.	Weight.	Periods.	Epochs.	Weight.	Periods.
		α			α
1610.8	5	....	1615.5	2	....
1619.0	1	8.2	1626.0	5	10.5
1634.0	2	15.0	1639.5	2	13.5
1645.0	5	11.0	1649.0	1	9.5
1655.0	1	10.0	1660.0	1	11.0
1666.0	2	11.0	1675.0	2	15.0
1679.5	2	13.5	1685.0	2	10.0
1689.5	2	10.0	1693.0	1	8.0
1698.0	1	8.5	1705.5	4	12.5
1712.0	3	14.0	1718.2	6	12.7
1723.5	2	11.5	1727.5	4	9.3
1734.0	2	10.5	1738.7	2	11.2
1745.0	2	11.0	1750.3	7	11.6
1755.2	9	10.2	1761.5	7	11.2
1766.5	5	11.3	1769.7	8	8.2
1775.5	7	9.0	1778.4	5	8.7
1784.7	4	9.2	1788.1	4	9.7
1798.3	9	13.6	1805.2	5	17.1
1810.6	8	12.3	1816.4	8	11.2
1823.3	10	12.7	1829.9	10	13.5
1833.9	10	10.6	1837.2	10	7.3
1843.5	10	9.6	1848.1	10	10.9
1856.0	10	12.5	1860.1	10	12.0
1867.2	10	11.2	1870.6	10	10.5
1878.9	10	11.7	1883.9	10	13.3
1889.6	10	10.7	1894.1	10	10.2
1901.7	10	12.1	1906.4	10	12.3
1913.4	10	11.7			

MISTPOEFFER, UMINARI, ATMOSPHERIC NOISES.

The noises long known in Holland as mistpoeffer were much talked of in Europe some 20 years ago, and articles relative to them will be found in the MONTHLY WEATHER REVIEW,[1] including several suggestions as to their possible origin. The noises seemed to come up out of or from the ocean and the waves, fog, or mist; their local names therefore indicated these local theories as to their origin. Similar sounds on Lake Seneca, N. Y., were known as the "Seneca guns;" the fishermen on the Banks of New Foundland knew them as "Seefahrts" "[Sea farts?]"; the similar sounds emanating from the drum fish as kept in our aquaria remind one of the mythical monster known to the Norsemen as Kraken, whose breathings caused the ocean tides. At Cape Haitien there appears to be a mysterious "gouffre" similar to rolling thunder and the Italians sometimes call similar noises "mugito."

Of all the natural methods of producing such sounds, such as distant cannonade or thunder near the coasts, or fog-horn calls reflected from the atmosphere or rocky bluffs, the most likely explanation is the reflection and transmission through the ocean of the booming of heavy surf against a rocky coast. This has now been first proposed by Dr. Terada in the journal of the Meteorological Society of Japan for July, 1915. He made a study of these noises on the southeast coast of Japan, by the use of Helmholtzian resonators, and we can not doubt that he has hit upon the correct explanation for the "mistpoeffer" of Holland and the "uminari" of Japan. The tremendous surf and breakers at Dover, on the rocky shores of Nova Scotia, the destructive "rollers" of St.

[1] Davison, quoted on "barisal guns." Monthly Weather Review, October, 1895, 23:375.
S. W. Kain, etc., "Seismic and oceanic noises." Ibid., April, 1898, 26:152-154.
Cancani, quoted on "marina" of Umbria. Ibid., May, 1898, 26:216.
W. A. Prosser, on the "lake guns" of Lake Seneca, N. Y. Ibid., July, 1903, 31:336.
C. F. Talman's note on "gouffre," "brontidi," "Nebelknall," etc. Ibid., December, 1907, 35:575.

Helena and Ascension, must each give rise to sounds that pass through 50 miles or so of water, producing interference maxima and minima as in thunder, and then emerge here and there from the gentle swells of the ocean. Thus a simple natural explanation is found for what has long been a puzzle to science and a mystery to the credulous.—[C. A.]

OCEANIC NOISES; UMINARI.[1]

By T. TERADA.

Oceanic noises, called "uminari" in Japanese, are common phenomena among the littoral of Japan.

On account of their intimate connection with the cyclonic centers, the sounds are observed and recorded at the meteorological stations and are reported to the central observatory in the daily weather telegrams. The oceanic noises resemble the rumbling of a heavy wagon passing over an uneven road or crossing a bridge. They are more distinctly audible at a distance of a few miles from the coast, rather than on the coast itself.

Undoubtedly the oceanic noises are produced by the breakers dashing on the coast, but how the breaking waves produce them is not fully understood. When waves break upon the shore they produce not only aerial vibrations, but also tremors in the ground, which are propagated to some distance; it seems uncertain, however, that these sounds, which are of such relatively short periods, are propagated through the porous ground to considerable distances. The aerial vibrations produced by the tremors of the ground are very small; the noises produced by the air escaping from the breaking waves would have a pretty large amplitude, although they would be somewhat irregular in period. On the shore these noises are confounded with a great variety of other noises, such as the rustling of beach pebbles, the dashing sounds of the water, etc. At a distance from the coast these other noises, having high frequencies, die out, and the oceanic noises, having comparatively long periods, survive.

There are many causes of the comparatively large limit of audibility of the oceanic noises. It is a noteworthy fact that in the case of oceanic noises the source of the sounds is not a single point, but is a line source distributed along the long shore line. In the case of a point source the intensity of the sound decreases in an inverse proportion to the square of the distance from the source. But in the case of multiple sources located along a straight line the case is somewhat different. When the sources produce sound waves of like phase, the resultant wave is cylindrical, and the intensity of the sounds is in simple inverse proportion to the distance. In the case of oceanic noises the sources may be supposed to lie in a straight line, but the waves from the different sources are in differing phases. In this case the intensity of the sound is decreased inversely proportional to the distance. If this simple consideration is approximately correct, the difference between the propagations of the sounds of cannonading and of oceanic noises would be readily explained. The intensity of the sounds from cannonading is reduced to one-hundredth at a distance of 10 fold, but that of the oceanic noises is reduced to only one-tenth at the same distance.

As a matter of fact, the cause of oceanic noises may not be such a simple one as that described above. Such a simple law may hold to some extent within a radius of a few hundred meters, but when the distance increases to several kilometers or more it is necessary to consider the influence of the distribution of winds and temperatures in the higher atmospheric strata. Here the study of oceanic sounds enters the realm of aerology.

Dr. Terada urges those who have the opportunity to measure the intensity of the oceanic sounds by the "Verdeckungsmethode," and to determine the frequencies by using Helmholtzian resonators, as he did during April, 1915, along the shore at Odawara, on the southwest coast of Honshu, Japan.

CIRRUS BANDS AND THE AURORA.

By DOUGLAS F. MANNING.

[Dated: Alexandria Bay, N. Y., Aug. 3, 1915.]

A condition worthy of noting was observed here Sunday, August 1; in fact, I have seen a similar condition on various occasions, but not so pronounced, showing either a coincidence or connection between the aurora and the cirrus clouds.

On the day mentioned, toward 11 a. m., a belt of cirro-stratus clouds formed in the northern sky about 30° above the horizon, beneath which the sky remained clear. This arch of cloud became quite well defined during the afternoon. Above, long cirrus streamers or mares' tails arose, having their base in the belt of cirro-stratus; in fact the cirrus clouds were taking every appearance of a display of the aurora, the clear space beneath the arch being especially marked. This state of affairs maintained with little change throughout the day, and when darkness came on imagine my surprise in seeing the sky lit up with the aurora, arranged, especially in regard to the arch, almost identical as that of the cirrus clouds. The display, however, did not last long, nor was it but a faint glow, but enough to make one wonder if the strange shapes of the cirrus clouds were in any way controlled by influences which cause the aurora.

[Compare similar observations reported by Birkeland and published in this REVIEW, April, 1914, 42: 211.—C. A., jr.]

EDDY MOTION IN THE ATMOSPHERE.[1]

By G. I. TAYLOR.

[*Reprinted from* Science Abstracts, Sec. A, May 28, 1915, §536.]

It has been known for a long time that the retarding effect of the surface of the earth on the velocity of the wind must be due in some way to eddy motion, but no detailed calculations appear to have been made on the subject. The present paper deals with the effect of a system of eddies on the velocity of the wind and also on the temperature and humidity of the atmosphere. Considering first the propagation of heat in a vertical direction the ordinary conductivity of heat by molecular agitation is extremely small, but a more potent effect may be produced by vertical transference of air, which retains its heat as it passes into regions where the potential temperature differs from that of the layer from which it

[1] *Reprinted from* Journal Meteorological Society of Japan, July, 1915, 34th year, No. 7.

[1] See Phil. Trans. Royal Society, 1915, 215: 1-26.

started. It appears, on calculation, that potential temperature (i. e., temperature assumed by a gas when its pressure is altered adiabatically to some standard pressure, will be transmitted upward through the atmosphere by means of eddies in the same way that temperature is transmitted in a solid of conductivity K, provided that $K\rho\sigma=\frac{1}{2}\omega d$; where ρ is the density and σ, the specific heat of air, ω represents the mean vertical velocity of the air in those places where it is moving upward, and d the average vertical distance traversed by the eddies; K is termed the "eddy conductivity" of the air. Now, if the temperature distribution in the air at any time is known and the subsequent changes at the base of the atmosphere, the temperature distribution at any later time can be calculated, assuming a value for K. The theory was put to the test by means of some kite ascents made from the ice scout ship *Scotia* in the North Atlantic. From these the upper-air temperature distribution was determined; and by tracing back the course of the air over the sea the different temperatures to which the surface layer had been exposed for the preceding few days were approximately obtained. The upper-air temperature distribution was found to agree well with that which would be expected from the theory, and calculation of K for the individual ascents gave values showing some proportionality to the mean wind velocity. As the eddy motion would naturally be more pronounced on days of strong wind, this result is satisfactory.

In the same manner that eddies effect a transference of heat between different parts of the atmosphere, so also will there be a transference of momentum from one air current to another. The velocity of the layer of air in immediate contact with the earth is reduced by the frictional drag, and assuming this reduction of velocity to be communicated to the upper layers by "eddy viscosity," certain relations between the surface and upper wind are worked out. The resulting height-velocity and height-direction curves obtained agree remarkably well with the mean results of observations made with pilot balloons on Salisbury Plain. One noteworthy feature in which the theoretical result agrees with the experimental is that the gradient wind velocity is attained by the actual wind at a less height than that at which the gradient direction is reached. The present theory agrees with the observed facts in several particulars where the previously existing theory of Guldberg and Mohn fails.—*J. S. Dines.*

NATURE OF THE ZODIACAL LIGHT.[1]

By F. SCHMID.

[*Reprinted from* Science Abstracts, Sec. A, June 25, 1915, §678.]

The suggestion is made that the zodiacal light may be due to sunlight reflected from the lenticular segment of the earth's atmosphere produced by the equatorial protuberance due to rotation. The difficulty that the phenomenon follows very closely the axis of the ecliptic and not the Equator is explained by suggesting that the atmospheric protuberance is displaced by the gravitational action of the sun and planetary systems, all of which are nearly in the ecliptic plane. The idea is elaborated by several excellent diagrams showing the coincidences with the observed phenomena.—*C. P. Butler.*

[1] See Archives des sciences, 1915, **39**:149-166, 237-246.

SECTION II.—GENERAL METEOROLOGY.

HOURLY PRESSURES FOR WASHINGTON, D. C., 1891-1904.

In the MONTHLY WEATHER REVIEW for November, 1906, Mr. Walter J. Bennett (now local forecaster at Tampa, Fla.), published the results of a discussion by harmonic analysis of the hourly pressures at Washington, as recorded there during 1891 to 1904, inclusive. As there has been some demand for the average hourly pressures upon which that analysis was based he here presents the detailed figures in Table 1, and also graphically as isopleths in figure 1.

The observational material was taken from the corrected barograms of the Richard barograph at the Washington station; and the values here published may be regarded as corrected for temperature and instrumental errors. The published figures have not been corrected for local gravity (corr., −0.016 inch), nor have they been reduced to sea level. The altitude of the barograph during the years here considered was 112 feet above mean sea level.

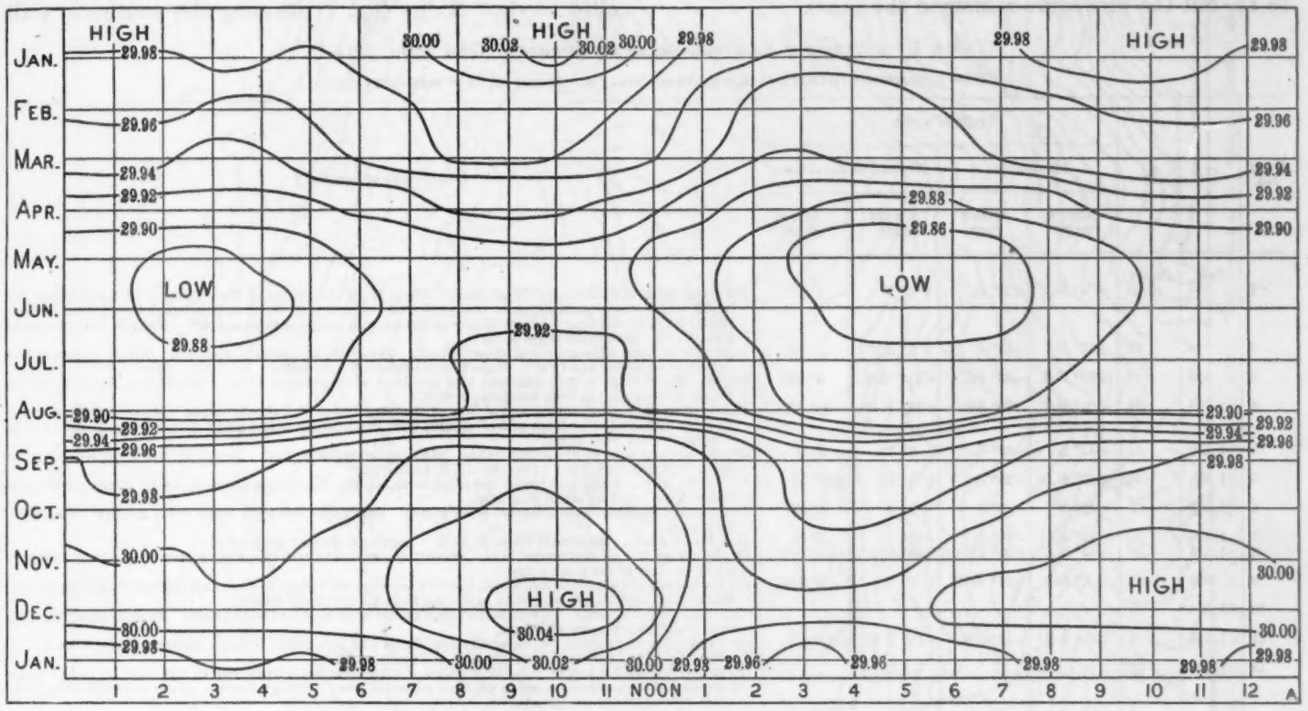

FIG. 1.—Isopleths of pressure for Washington, D. C., 1891–1904.

TABLE 1.—*Averages hourly pressures at Washington, D. C., for the 14 years 1891 to 1904, inclusive.*

[Corrected for temperature and instrumental error; not reduced to sea level; correction for local gravity is −0.016 in., and has not been applied.]

29 inches +

Month.	A. M.												P. M.												Mean.	Month.
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
																									Inches.	
Jan.	0.9755	0.9795	0.9832	0.9801	0.9788	0.9848	0.9940	1.0059	1.0196	1.0262	1.0188	0.9944	0.9731	0.9607	0.9586	0.9606	0.9647	0.9726	0.9799	0.9843	0.9868	0.9867	0.9848	0.9794	29.9847	Jan.
Feb.	.9611	.9610	.9583	.9551	.9601	.9656	.9744	0.9845	0.9926	0.9935	0.9891	.9750	.9506	.9327	.9264	.9261	.9319	.9412	.9513	.9556	.9610	.9631	.9614	.9603	.9559	Feb.
Mar.	.9559	.9543	.9474	.9476	.9559	.9636	.9744	.9825	.9861	.9856	.9776	.9650	.9480	.9295	.9195	.9207	.9243	.9322	.9417	.9456	.9526	.9574	.9584	.9569	.9521	Mar.
Apr.	.9166	.9110	.9096	.9106	.9170	.9283	.9393	.9426	.9449	.9451	.9372	.9241	.9111	.8966	.8811	.8557	.8762	.8787	.8852	.8991	.9106	.9135	.9164	.9186	.9121	Apr.
May.	.8850	.8798	.8790	.8821	.8892	.9006	.9091	.9146	.9154	.9146	.9099	.8991	.8864	.8742	.8517	.8506	.8480	.8490	.8564	.8655	.8788	.8853	.8871	.8890	.8837	May.
June.	.8819	.8779	.8756	.8790	.8868	.8963	.9038	.9104	.9111	.9108	.9081	.9000	.8888	.8772	.8656	.8586	.8519	.8524	.8575	.8634	.8734	.8818	.8839	.8838	.8820	June.
July.	.8943	.8904	.8874	.8897	.8979	.9059	.9144	.9204	.9219	.9224	.9201	.9139	.9013	.8889	.8774	.8684	.8640	.8650	.8690	.8761	.8859	.8926	.8946	.8963	.8939	July.
Aug.	.8940	.8894	.8877	.8875	.8933	.9029	0.9117	0.9182	0.9231	0.9256	0.9236	.9168	.9063	.8933	.8791	.8716	.8692	.8677	.8716	.8809	.8920	.8959	.8974	.8986	.8957	Aug.
Sept.	.9796	.9769	.9751	.9774	.9829	.9918	1.0029	1.0089	1.0146	1.0161	1.0102	0.9991	.9834	.9664	.9553	.9478	.9471	.9509	.9564	.9666	.9746	.9794	.9804	.9809	.9806	Sept.
Oct.	.9894	0.9864	.9831	.9845	0.9893	0.9975	1.0080	1.0192	1.0244	1.0238	1.0175	1.0025	.9809	.9675	.9596	.9553	.9571	.9649	.9736	.9804	0.9878	0.9921	0.9919	0.9901	.9850	Oct.
Nov.	0.9994	1.0001	0.9999	0.9994	1.0037	1.0084	1.0251	1.0289	1.0341	1.0356	1.0286	1.0072	.9869	.9734	.9697	.9724	.9754	0.9850	0.9935	0.9994	1.0037	1.0059	1.0046	1.0049	30.0089	Nov.
Dec.	1.0098	1.0111	1.0136	1.0102	1.0085	1.0141	1.0239	1.0335	1.0436	1.0506	1.0420	1.0203	.9992	.9880	.9847	.9880	.9919	1.0007	1.0087	1.0136	1.0169	1.0180	1.0181	1.0136	30.0129	Dec.
Year.	0.9451	0.9431	0.9416	0.9419	0.9469	0.9549	0.9646	0.9726	0.9777	0.9791	0.9736	0.9599	0.9431	0.9290	0.9196	0.9154	0.9162	0.9210	0.9281	0.9358	0.9445	0.9482	0.9489	0.9483	29.9463	

NOTE ON THE EFFECTS OF RAINGAGE EXPOSURES.

By WILLIAM GARDNER REED.

[Dated: University of Chicago, July 15, 1915.]

For the past two years the University of California has been engaged in an intensive study of the rainfall conditions over the watershed of Strawberry Creek, which has an area of about 1 square mile, in the attempt to determine its possibilities as a source of water supply for the university grounds and buildings. Rainfall and runoff surveys were made during 1913–14 by Howard M. Loy,[1] and during 1914–15 by Marshall K. White, both senior students in the College of Civil Engineering. The work was done under the immediate direction of Prof. Charles G. Hyde, although the writer was consulted in regard to the meteorological aspects of the work. During 1913–14 rainfall measurements were made from 5 standard 8-inch gages, visited at the end of each storm. I the autumn of 1914 the number of gages was increased to 13, but the procedure remained the same.

From a strictly meteorological point of view the most important result so far seems to be the difficulty, if not the impossibility, of determining the precipitation on a watershed by means of ordinary raingages. It was hoped to make experiments with shielded gages, but this could not be carried out. As has often been recognized, the problem of determining the amount of water which falls on a given area is far from simple, and the complexity is greatly increased when the area is broken into valleys and ridges. The problem of rainfall measurement is apparently simple; it is merely to determine the depth of water which falls on a given area. But in practice numerous difficulties are met with. Theoretically an 8-inch gage exposed in a position where the rainfall is about the average for the area should give a sample of the precipitation of the whole region; but it has often been noted that the catch of the gage is largely controlled by local conditions. Prof. C. F. Marvin [2] has stated the exposure problem as follows:

> The exposure of raingages is a very important matter. The wind is the most serious disturbing cause in collecting precipitation. In blowing against the gage the eddies of wind formed at its top and about the mouth carry away rain and too little is caught.
>
> Raingages in slightly different positions, if badly exposed, catch very different amounts of rain. Within a few yards of each other two gages may show a difference of 20 per cent in the rainfall of a heavy storm. The stronger the wind the greater the difference is apt to be. * * * Since the value of the precipitation records depends so greatly upon proper exposure, particular care should be taken in selecting a place for the location of the gage. * * * If possible, a position should be chosen in some open lot, unobstructed by large trees or buildings. Low bushes and fences or walls that break the force of the wind in the vicinity of the gage are beneficial, if at a distance not less than the height of the object.

It is doubtful if there is a single good exposure in the area under investigation; it therefore becomes necessary to make the best of the exposures available. The results of the first year's work seemed to indicate that the ridge called Skyline Ridge (fig. 1) forming the southerly wall of the canyon was a region of heavier rainfall, and therefore 3 of the additional gages supplied for 1914–15 were located on it. The gages numbered 1 to 5 were located in the same positions as in 1913–14, and the others were placed in representative positions which seemed to have relatively good exposures. Gage 5′ was placed near gage 5, which had given the least consistent readings in 1913–14, in an effort to determine whether the irregularities represented real differences in rainfall or were due to poor exposure conditions. It was intended to shield gage 5′, but with the funds available no screen could be erected which would withstand the wind and the interference by horses and cattle. Gage 5′, however, gives more consistent measurements than gage 5, although its total catch is smaller. The map (fig. 1) and Table 1 give the details of the exposure of the 13 gages during 1914–15.

TABLE 1.—*Exposure of field raingages in the Strawberry Creek basin, 1914–15.*

[H = approximate elevation of gage above sea level. h_r = height of rim of gage above ground.]

Gage No.	H.	h_r.	Angle of slope.				Description of location.*
			Maximum.		Normal to maximum.		
			Above gage.	Below gage.	Above gage.	Below gage.	
	Feet.	*Inches.*					
1	520	10–20	+ 4° N.	−28° S.	+ 5° E.	− 5° W.	On steep bank of Strawberry Creek, about 25 feet N. of the center of the channel and 5 feet below the break where the ground drops to the creek bed. Above and N. from this break the ground is practically level for 125 feet. Across the creek the canyon wall slopes about 40°. Gage is well protected from wind. Maximum slope N. to S.
2	730	22	+17° N.	−15° S.	+ 5° E.	−15° W.	East side of large slide into Strawberry Creek. 40 feet N. of center of channel. Across the creek the canyon wall slopes nearly 45°. Gage is well protected from wind. Maximum slope N. to S
3	880	18	+30° NE.	−23° SE.	+18° NW.	0° SE.	Slightly N. of ridge of spur between two branches of Strawberry Creek. Maximum slope N. 30° E. Fairly well protected from southerly winds.
4	1,225	18	+25° NE.	−20° SE.	+10° NW.	−20° SE.	In a shallow depression at the head of one of the branches of Strawberry Creek. Maximum slope N. 30° E. Gage surrounded by large pile of stones, with top 3 inches below and 6 inches away from the rim. Well protected from wind.
5	1,270	14	+12° N.	−22° S.	− 5° W.	− 8° E.	On ridge line of spur of Frowning Ridge. Maximum slope N. to S. Swept by winds deflected by the main ridge through 2 low passes from SE. to NW.
5′	1,270	18	+12° N.	−22° S.	+ 5° E.	−12° W.	15 feet W. of No. 5, slightly below the ridge of the spur. Maximum slope N. to S. Gage partly protected from wind by small pine tree.
6	1,250	22	+12° N.	+ 7° S.	− 3° E.	− 3° W.	In a flat saddle fairly well protected from winds. Pine tree 3 feet high, 8 feet NE.; another 10 feet SW. from gage.
7	1,190	16	+15° N.	−15° S.	−12° W.	− 5° E.	In a broad draw. Maximum slope N. to S. Gage unprotected from winds.
8	1,180	18	+15° NE.	+30° SW.	−30° SE.	−25° NW.	In a low pass NE. of Monument Hill. Maximum slope NE. to SW. Pass is swept by winds deflected along the face of the main ridge.
9	915	12	+ 3° SE.	−30° NW.	+ 2° NE.	− 3° SW.	On the lower edge of a small dell about halfway between Strawberry Creek and the top of Skyline Ridge. Maximum slope N. 30° W. Well protected from all southerly winds.
10	1,210	12	.....	.....	.....	.....	Unprotected from winds. All slopes flat for a radius of 40 to 60 feet from gauge. Records incomplete on account of interference with gage.
11	1,315	8	+20° NE.	+12° SW.	−18° NW.	−15° SE.	In a low pass at junction between Skyline Ridge and Frowning Ridge. Maximum slope N. 30° E. Swept by winds deflected from the face of Frowning Ridge.
12	1,655	16	.....	.....	.....	.....	On broad flat at the top of Frowning Ridge. All slopes flat within 100 to 200 feet of gage. Gage surrounded by a pile of stones to within 4 inches of rim. Though there is no evident protection from wind, strong winds are infrequent.

*For the larger topographic relations see the map, figure 1.

[1] **Reed, W. G., & Loy, H. M.:** The water resources of Strawberry Creek, Berkeley, Cal. Monthly Weather Review, 43; 35–39, Washington, January, 1915.

[2] **Marvin, C. F.** The measurement of precipitation. Washington, 1913, pp. 5–6. (U. S. Weather Bureau, Inst. Div. Circular E.)

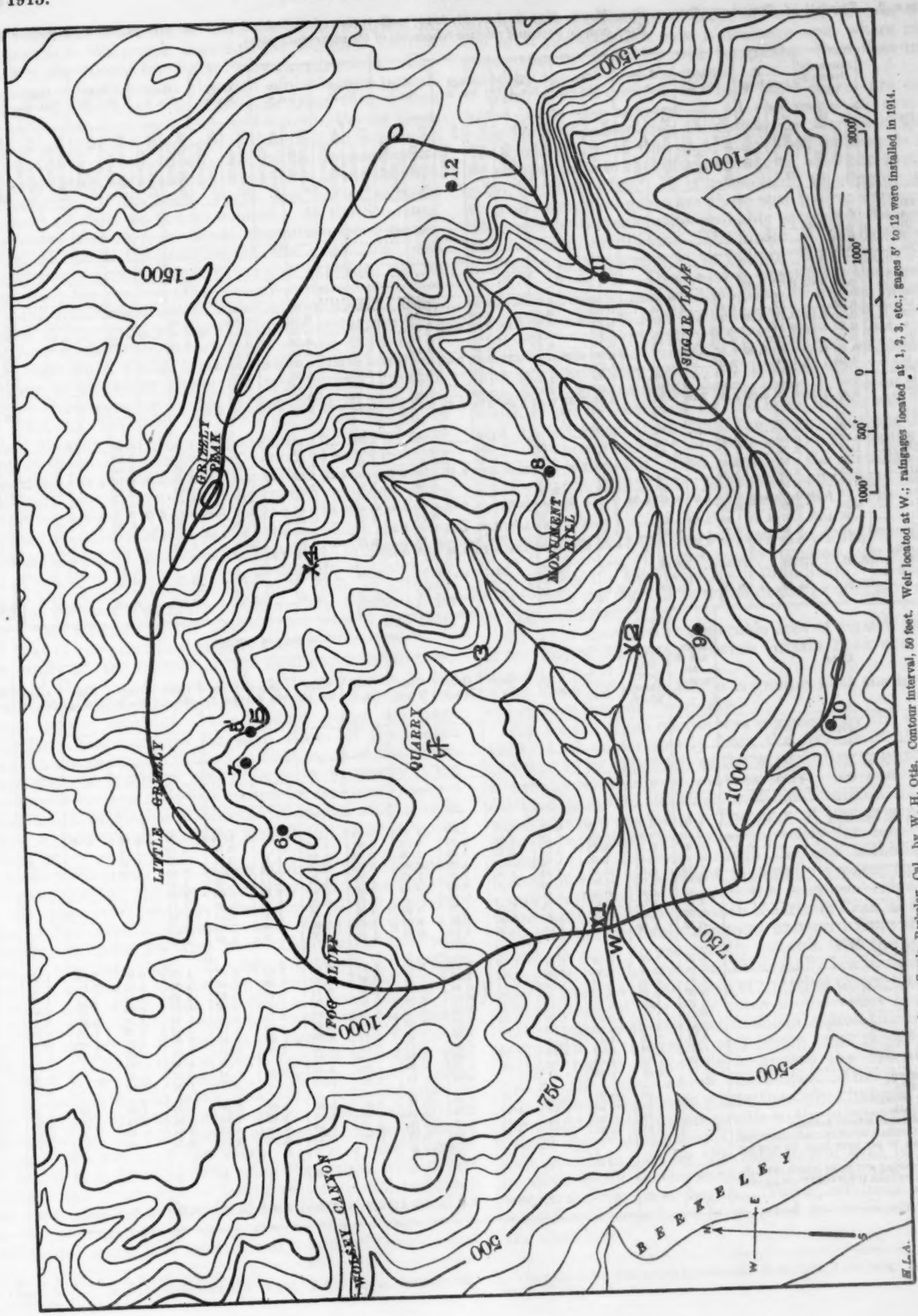

FIG. 1.—Contour map of Strawberry Creek, Berkeley, Cal., by W. H. Otis. Contour interval, 50 feet. Weir located at W.; raingages located at 1, 2, 3, etc.; gages 5' to 12 were installed in 1914.

TABLE 2.—*Rainfall of Strawberry Canyon from May 1, 1914 to Apr. 30, 1915, with ratios of individual gages to average, showing variation of rain from gage to gage and relative reliability of the individual gages.*

Date.	Students' Observatory.		C. E. building.		Gage No. 1.		Gage No. 2.		Gage No. 3.		Gage No. 4.		Gage No. 5.		Gage No. 5′.		Gage No. 6.		Gage No. 7.		Gage No. 8.		Gage No. 9.		Gage No. 10.		Gage No. 11.		Gage No. 12.	
	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.	Rain during storm.	Total for month.
1914.																														
May 8	0.21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	0.41	0.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
June 7	0.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	0.10	0.48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
July —.	.....	0.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Aug. —.	.....	0.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sept. 7	0.02	0.02	0.02	0.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.07	.....	0.05	.....	0.03	.....	0.02	.....	.....	.....	.....	.....
Oct. 10	0.02	.....	0.04	.....	0.03	.....	0.05	.....	0.04	.....	0.05	.....	0.06	.....	.....	.....	.....	.....	0.55	.....	0.81	.....	1.09	.....	.....	.....	0.85	.....	0.76	.....
17	0.62	.....	0.57	.....	0.67	.....	0.78	.....	0.65	.....	0.67	.....	0.62	.....	0.79	.....	.....	.....	0.26	0.88	0.32	1.18	0.31	1.43	.....	.....	0.35	.....	0.34	.....
20	0.21	0.84	0.19	0.80	0.28	0.98	0.30	1.13	0.23	0.92	0.27	0.99	0.24	0.92	0.23	.....	0.30	.....	0.18	.....	0.19	.....	0.20	.....	0.19	.....	0.19	.....	0.19	.....
Nov. 1	0.22	.....	0.20	.....	0.19	.....	.....	.....	0.19	.....	0.18	.....	0.18	.....	0.17	.....	0.20	.....	0.16	.....	0.15	.....	.....	.....	.....	.....	.....	.....	0.17	.....
28	0.13	.....	0.13	.....	0.14	.....	0.15	.....	0.16	.....	0.17	.....	0.16	.....	0.16	.....	0.17	.....	0.16	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.05	0.41
30	0.08	0.43	0.07	0.40	0.07	0.40	0.05	.....	0.04	0.39	0.02	0.37	0.04	0.38	0.04	0.37	0.06	0.43	0.05	0.39	0.05	0.39	.....	.....	.....	.....	.....	.....	1.97	.....
Dec. 6	2.10	.....	1.74	.....	2.02	.....	.....	.....	1.73	.....	1.76	.....	1.68	.....	1.32	.....	2.00	.....	1.60	.....	2.07	.....	.....	.....	.....	.....	.....	.....	1.49	.....
10	1.55	.....	1.38	.....	1.70	.....	1.68	.....	1.49	.....	1.45	.....	1.47	.....	1.20	.....	1.52	.....	1.31	.....	1.54	.....	.....	.....	.....	.....	.....	.....	2.63	.....
18	2.60	.....	2.65	.....	2.97	.....	2.85	.....	3.02	.....	2.85	.....	2.80	.....	2.36	.....	2.75	.....	2.76	.....	1.96	.....	.....	.....	.....	.....	.....	.....	0.35	6.44
27	0.33	6.58	0.25	6.02	0.35	7.04	0.32	.....	0.33	6.57	0.32	6.38	0.38	6.33	0.32	5.20	0.35	6.62	0.34	6.01	0.35	5.92	.....	.....	.....	.....	.....	.....	.....	.....
1915.																														
Jan. 7	1.25	.....	1.17	.....	1.20	.....	1.30	.....	1.17	.....	1.19	.....	1.04	.....	1.02	.....	1.29	.....	1.15	.....	1.19	.....	1.16	.....	1.29	.....	1.27	.....	1.19	.....
9	0.94	.....	0.89	.....	0.92	.....	0.95	.....	0.94	.....	0.97	.....	0.86	.....	0.82	.....	1.02	.....	0.90	.....	0.96	.....	0.99	.....	0.99	.....	1.00	.....	1.00	.....
15	1.46	.....	0.99	.....	1.27	.....	1.35	.....	1.11	.....	1.13	.....	0.83	.....	0.87	.....	1.40	.....	1.00	.....	1.37	.....	1.31	.....	0.84	.....	1.48	.....	1.35	.....
Feb. 4	4.78	8.43	4.51	7.56	5.46	8.85	.....	.....	4.75	7.97	4.90	8.19	3.40	6.13	3.74	6.45	5.56	9.27	4.52	7.57	5.85	9.37	5.82	9.28	6.70	9.82	6.97	10.72	5.89	9.43
11	2.83	.....	2.76	.....	3.32	.....	3.19	.....	2.94	.....	2.79	.....	2.15	.....	2.23	.....	1.97	.....	2.59	.....	3.18	.....	2.89	.....	2.53	.....	3.42	.....	3.10	.....
24	3.44	.....	3.10	.....	3.52	.....	3.33	.....	3.45	.....	3.18	.....	2.86	.....	2.76	.....	3.46	.....	3.79	.....	3.75	.....	3.47	.....	3.62	.....	3.71	.....	3.70	.....
28	0.44	6.71	0.42	6.28	0.43	7.27	0.43	6.95	0.43	6.82	0.40	6.37	0.50	5.51	0.45	5.44	0.43	5.86	0.48	6.86	0.40	7.33	0.37	6.73	0.44	6.59	0.41	7.54	0.40	7.20
Mar. 14	0.25	.....	0.25	.....	0.25	.....	.....	.....	0.28	.....	0.22	.....	0.11	.....	0.20	.....	0.21	.....	0.10	.....	0.18	.....	0.21	.....	0.20	.....	0.25	.....	0.25	.....
31	1.58	1.83	1.37	1.62	1.85	2.10	1.88	.....	1.83	2.11	1.63	1.85	1.44	1.55	1.24	1.44	.....	.....	1.65	1.75	1.68	1.86	1.94	2.15	.....	.....	1.77	2.02	1.93	2.18
Apr. 8	0.26	.....	0.22	.....	0.24	.....	0.24	.....	0.27	.....	0.21	.....	0.18	.....	0.15	.....	0.20	.....	0.20	.....	0.18	.....	0.22	.....	.....	.....	0.24	.....	0.24	.....
29	0.71	0.97	0.69	0.91	0.71	0.95	.....	.....	0.67	0.94	0.69	0.90	0.71	0.89	0.66	0.81	.....	.....	0.75	0.95	0.73	0.91	0.77	0.99	.....	.....	0.84	1.08	0.76	1.00
Total observed	26.91	.....	23.59	.....	27.59	.....	18.85	.....	25.72	.....	25.05	.....	21.71	.....	20.73	.....	22.89	.....	24.42	.....	27.06	.....	20.78	.....	16.82	.....	22.75	.....	27.76	.....
Expanded total	26.91	.....	24.49	.....	28.79	.....	28.79	.....	26.91	.....	26.10	.....	22.60	.....	21.53	.....	27.18	.....	25.30	.....	28.26	.....	29.06	.....	29.06	.....	32.03	.....	29.06	.....

Date.	Average of all records.	Ratios of individual gages to average.															
		Students' Observatory.	C. E. building.	Gage No. 1.	Gage No. 2.	Gage No. 3.	Gage No. 4.	Gage No. 5.	Gage No. 5′.	Gage No. 6.	Gage No. 7.	Gage No. 8.	Gage No. 9.	Gage No. 10.	Gage No. 11.	Gage No. 12.
1914.																
May 8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
June 7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
July —.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Aug. —.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sept. 7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oct. 10	0.04	0.50	1.00	0.75	1.25	1.00	1.25	1.50	.....	.....	1.75	1.25	0.75	0.50	.....	.....
17	0.72	0.85	0.79	0.93	1.08	0.90	0.93	0.86	1.10	.....	0.76	1.12	1.51	.....	1.18	1.06
20	0.27	0.78	0.70	1.04	1.11	0.85	1.00	0.89	0.85	1.11	0.96	1.19	1.15	.....	1.30	1.26
Nov. 1	0.19	1.16	1.05	1.00	.....	1.00	0.95	0.95	0.89	1.05	0.95	1.00	1.05	1.00	1.00	1.00
28	0.15	0.87	0.87	0.93	1.00	1.07	1.13	1.07	1.07	1.13	1.07	1.00	.....	.....	.....	1.13
30	0.05	1.60	1.40	1.40	1.00	0.80	0.40	0.80	0.80	1.20	1.00	1.00	.....	.....	.....	1.00
Dec. 6	1.82	1.15	0.95	1.11	.....	0.95	0.97	0.92	0.73	1.10	0.88	1.14	.....	.....	.....	1.08
10	1.48	1.05	0.93	1.15	1.14	1.01	0.98	0.99	0.81	1.03	0.89	1.04	.....	.....	.....	1.01
18	2.77	0.94	0.96	1.07	1.03	1.09	1.03	1.01	0.85	1.00	1.00	0.71	.....	.....	.....	0.95
27	0.33	1.00	0.76	1.06	0.97	1.00	0.97	1.15	0.97	1.06	1.03	1.06	.....	.....	.....	1.06
1915.																
Jan. 7	1.19	1.05	0.97	1.01	1.09	0.97	1.00	0.87	0.86	1.08	0.97	1.00	0.97	1.08	1.07	1.00
9	0.94	1.00	0.95	0.98	1.01	1.00	1.03	0.92	0.87	1.08	0.96	1.02	1.05	1.05	1.06	1.06
15	1.18	1.24	0.84	1.08	1.14	0.94	0.96	0.70	0.74	1.19	0.85	1.16	1.11	0.71	1.25	1.14
Feb. 4	5.20	0.92	0.87	1.05	.....	0.91	0.94	0.55	0.72	1.07	0.87	1.12	1.12	1.29	1.34	1.13
11	2.79	1.01	0.95	1.19	1.14	1.05	1.00	0.77	0.80	0.71	0.89	1.14	1.04	0.91	1.23	1.11
24	3.41	1.01	0.91	1.04	0.98	1.01	0.93	0.84	0.81	1.02	1.11	1.10	1.02	1.06	1.09	1.09
28	0.43	1.02	0.98	1.00	1.00	1.00	0.93	1.16	1.05	1.00	1.12	0.93	0.86	1.02	0.95	0.93
Mar. 14	0.21	1.19	1.19	1.19	.....	1.34	1.05	0.52	0.95	1.00	0.48	0.86	1.00	0.95	1.19	1.19
31	1.68	0.94	0.82	1.10	1.12	1.09	0.97	0.86	0.74	.....	0.98	1.00	1.15	.....	1.05	1.15
Apr. 8	0.22	1.18	1.00	1.09	1.09	1.23	0.96	0.82	0.68	0.91	0.91	0.82	1.00	.....	1.09	1.09
29	0.70	1.01	0.99	1.01	.....	0.96	0.99	1.01	0.95	.....	1.07	1.04	1.10	.....	1.20	1.09
Total observed	25.77	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average ratio	.....	1.00	0.91	1.07	1.07	1.00	0.97	0.84	0.80	1.01	0.94	1.05	1.08	1.08	1.19	1.08
Maximum ratio	.....	1.24	1.19	1.19	1.14	1.34	1.13	1.16	1.10	1.19	1.12	1.19	1.51	1.29	1.34	1.26
Minimum ratio	.....	0.78	0.28	0.14	0.10	0.34	0.16	0.32	0.30	0.30	0.18	0.34	0.43	0.37	0.24	0.15
Greatest divergence from average	.....	0.24	0.28	0.14	0.10	0.39	0.16	0.32	0.30	0.30	0.18	0.34	0.43	0.37	0.24	0.15
Number of storms in which ratio diverged more than 10 per cent from its average value	.....	10	6	4	1	4	3	10	6	4	5	6	3	4	5	3
Total rain during storms in which ratio diverged more than 10 per cent from its average value	.....	4.85	1.77	1.02	0.04	0.74	0.24	12.50	2.69	3.06	6.01	5.12	1.19	5.45	7.82	3.47

The results of the work of 1913–14 were published in the MONTHLY WEATHER REVIEW for January, 1915.[3] Table 2 is the record for 1914–15 by rain periods. The field gages were visited at the end of each rain period. Readings of the gage at the Students' Observatory were made twice each day, at 8 a. m. and 8 p. m., Pacific time. The gage at the Civil Engineering Building, 60 feet above the ground, is an electrically recording tipping-bucket Friez gage, but check readings have been made by stick measurements. Both these gages are better exposed than most of those on the watershed. At the Students' Observatory the 25-year record shows apparent homogeneity, although the position of the gage has been changed twice, and for seven years this exposure was on the ground; the present Observatory exposure is 15 feet above the ground and is fair, although not ideal.[4] Comparisons of the gage at the Civil Engineering Building with that at the observatory made during 1914–15 by White indicate a probable total error of the recording gage due to elevation above the ground and inherent error of the recording device of less than 10 per cent. The relations between the two gages are shown in Table 2 for each rain period of the year. Neither of these gages is located on the drainage area. The records are introduced, as they probably show the general rainfall conditions better than the more poorly exposed gages on the watershed. They are both on the flatter slope which extends from the foot of the steep slope shown at the western edge of the map (fig. 1) to San Francisco Bay. The grade from the foot of the steep slope is about 300 feet to the mile for the first half mile, from an altitude of about 400 feet, and much flatter for the 2 miles to the Bay. The altitude of the observatory gage is 325 feet, and that of the recording gage is 410 feet.

A study of the records of the field gages for the two years of observation shows very wide variations in the catch of the different gages, and further that the variations in the catch of the individual gages are most irregular. The relations for each storm of the season 1914–15 are shown in Table 2. That some of the differences are the result of real differences in precipitation can hardly be doubted; the record for Oakland, about 5 miles south of Berkeley, shows differences of the same order as between these gages and of the same irregular character.

As a preliminary step in the study of the differences the records of all the gages were averaged for each storm. If the gage readings were true records of the precipitation at the place of exposure and the gages were well distributed, these averages would indicate the precipitation on the watershed. The ratios between the average and the individual catches are shown in Table 2. The average gage catch does not give a correct idea of the general precipitation conditions over the watershed because neither of the postulates agrees with the facts. Figure 1 shows that the gages are not uniformly distributed over the watershed, although when placing them the aim was to select districts as representative of the varying conditions as possible. The study of the records shows that the lowest catches are those of gages open to the sweep of the wind. However, the average is useful as a basis of comparing the gages with themselves; the errors due to faulty exposure will certainly be more irregular in the case of any particular gage than in the average for all the gages, as the differences for individual gages will tend to vary with different wind directions and velocities. It is, of course, obvious that the total precipitation over a drainage area where rain-gage exposure is faulty will be greater than that indicated by the catch of the gages.

When the records of the individual gages are compared with the average of all the gages an average ratio for the season can be determined for each gage. The consistency of the gage may then be ascertained by comparing the ratio for each storm with the average ratio for the gage. It is reasonable to suppose that the more irregular gages are those with poorer exposures. The more consistent ratios probably approach the actual precipitation conditions. The order of consistency of the ratios of the gages is as follows: 2, 4, 3, 1, 9, 5′, 6, 12, 8, 7, 10, 11, 5. This order is practically the same as that of the protection of the gages from the sweep of the wind. The relative consistency of gages 5 and 5′ is of interest; these gages, although only 15 feet apart, differ 20 per cent for certain storms. The exposure of both is undoubtedly bad, but 5′ is much more consistent than 5. This is probably due to better protection of 5′, which is partly sheltered by the crest of the ridge and also by the small trees near the gage. But the catch of 5′ is even smaller than that of 5. The indication, especially since the other gages in the vicinity show small records, is that this region is actually one of smaller rainfall and that the low readings are not wholly due to poor exposure.

While it is, perhaps, not legitimate to draw conclusions from the records of gages poorly exposed, the observations during the two years seem to indicate:

(1) That the rainfall over the drainage area is heaviest on the southeast ridge.

(2) That there is a considerable area of smaller rainfall in the line of the notch between Grizzly Peak and Little Grizzly.

(3) That the precipitation is greater near the heads of the valleys than on the ridges.

The first of these results was suggested by the work of 1913–14; it shows clearly from the records of 1914–15, and was to be expected, as the wind during precipitation is usually southerly or southeasterly. No results from shielded gages on the ridge or of conditions on the windward side are available. The area of low precipitation may be explained by the opportunity for considerable masses of air to pass through the gap without being forced upward to a height materially greater than previously attained in crossing the southern ridge. This ridge continues from the south to Grizzly Peak, so that the precipitation probably increases eastward from the drier area. It is, of course, wholly possible that the gages in this portion of the area read abnormally low because of the poor exposure and the sweep of the wind through the pass. The relations of the gage catch in the valley heads and on the ridges is also subject to the interpretation of better protection of the gages, and hence truer records in the valleys; but it is possible to regard the differences as due to the relations of the slopes. The gages were exposed near the places where the slope changes from the somewhat gentler stream profile to the steeper gully head. Casual observations show that the air movement is probably guided in part by the valleys, and that the change in slope tends to concentrate the rainfall near the place where the increase begins. These relations between rainfall and slope have been noted in the Sierra Nevada and elsewhere.[5]

[3] **Reed, W. G., & Loy, H. M.** Op. cit., p. 37.
[4] **Reed, W. G.** The rainfall of Berkeley, Cal. Univ. Cal. Publ. Geog., Berkeley, 1913. 1:63–79 (no. 2), pp. 65–66.

[5] **McAdie, A. G.** The rainfall of California. Univ. Calif., Publ. Geog. Berkeley, 1914. 1:127–240 (No. 4), p. 154.

The study of the rainfall over the drainage area of Strawberry Creek is in no sense finished. The conclusions here presented must be regarded as provisional. One result, however, is clearly evident, and that is that the exposure of raingages, local as well as general, needs much careful study. The attempt to determine the amount of water falling on a drainage area is beset with difficulties, relating first to the relation between the catch of the raingage and the actual rainfall in its immediate vicinity, and second to the distribution of precipitation in different parts of a diversified watershed. Studies like that upon which this report is based should be continued not only for Strawberry Creek, but for other areas, small and large, until the relations between rainfall and rainfall measurements are better known. A word of caution is necessary: Although it is probable that many rainfall records are not accurate statements of the actual precipitation, they are the best available and should not be rejected out of hand. Such records may and should in time be supplemented by more accurate data, but as they stand they represent accumulated material of great value, which should not be rejected, except for good reason. The purpose of this report is to indicate how detailed work may increase the information already obtained, and to show the relations upon which detailed water supply studies may be based. The most important single result of the two years' work is probably the clear indication that, at least in wind-swept regions, some kind of shielding of the gage is highly desirable if accurate records are to be obtained.

DISTRIBUTION OF THUNDERSTORMS IN THE UNITED STATES.

By WILLIAM H. ALEXANDER, Local Forecaster.

[Dated: Weather Bureau, Cleveland, Ohio, July 28, 1915.]

INTRODUCTION.

The writer confesses to a peculiar admiration for the thunderstorm, being ever and always deeply impressed with the beauty and sublimity exhibited in its approach and passage. Led on by this natural impulse, direct and thoughtful attention has been given to these storms for quite a number of years and over a considerable area measured in degrees of latitude (17° to 44° N. lat.). Not only so, but all available literature bearing on them has been read with diligence. The primary purpose of this paper, however, is to present in a brief, simple way some data on the distribution of thunderstorms over the United States and the neighboring Canadian Provinces. The material has been collected by the approval of the Chief of Bureau and with the assistance extended by officials in charge of the various stations. There seems to be a real need for some more definite, detailed, and up-to-date statistics on the subject; perhaps the information will serve to supplement the paper on the thunderstorm by Prof. W. J. Humphreys.[1]

As suggested by Prof. Humphreys in his paper, "the geographic distribution of the thunderstorm may safely be inferred from the fact that it is caused by strong vertical convection of humid air." This distribution over the United States and southern Canada is clearly shown on the accompanying charts (W. H. A.—1 to 13; XLIII–71 to 83). These charts also bring out the relative frequency and distribution of these storms for the different months of the year; and when studied in conjunction with corresponding charts of temperature, humidity, and precipitation, they will suggest to the student of meteorology many interesting, intimate relations between these various factors.

The graphic charts are supplemented by detailed tabulated data for individual stations, having fairly long records, showing the number of storms for each month for the entire period covered by the record. It will be observed that in most cases there is a marked discrepancy between the number recorded in the early years of the record as compared with the number in recent years. This is probably due to the fact that the instructions governing the recording of thunderstorms were more definite and positive and the observers more careful during the latter part of the record.

METHODS OF THUNDERSTORM RECORDING USED BY THE UNITED STATES SIGNAL SERVICE AND THE WEATHER BUREAU.[2]

1871. The earliest edition of Instructions to Observer Sergeants on file in the Weather Bureau Library is that published in 1871. On page 19 of this work, in connection with instructions for entries in the "journal," is found the following:

> In the journal will be entered daily all matters of interest not provided for in the various forms, such as meteoric and auroral displays, earthquakes, and unusual atmospheric appearances and disturbances, giving in all cases, when possible, the time of beginning and duration of each. Especially will the observer enter a detailed account of the characteristic phenomena of every serious storm that passes over his station.

No specific mention of thunderstorms is made either in the paragraph above quoted or elsewhere in these instructions. This paragraph appears to have remained practically unchanged in the Instructions to Observer Sergeants until 1879. (See below.)

1874. An early mention of the recording of thunderstorms by the Signal Service is found in connection with the explanation of Form E—Division of Telegrams and Reports for the Benefit of Commerce. (See Annual Report, Chief Signal Officer, 1874, p. 290), as follows:

> *Thunderstorms.*—Time of occurrence and direction of motion * * *.

1879. In the instructions to Observer Sergeants, 1879, page 70, occurs the following reference to thunderstorms:

> The abstract [of the journal] should show clearly and briefly all matters of interest not provided for in the regular forms, such as flight of birds, early vegetation * * * meteoric and auroral displays, earthquakes, thunderstorms, distant lightning, high winds and gales * * * giving whenever practicable the time of beginning and duration of each.

1881. Instructions to Observers of the Signal Service, U. S. A., Washington, 1881, page 91, contains practically the same instructions for recording thunderstorms as that quoted above from the edition of 1879. In addition, on page 63 of the 1881 edition, appears the following:

> The state of the weather will be determined as follows:
> * * * thunderstorm with light or heavy rain, when a thunderstorm is prevailing at the moment of the observation, or the rain is still falling, although neither thunder has been heard nor lightning observed for some time previous to the observation.

Signal Service Order No. 16, April 5, 1881, contains the following:

> * * * Observers will record in their journals and, in a condensed form, under "Remarks," in Original Record and all other

[1] See this REVIEW, June, 1914, 43: 348-380.

[2] Contributed by the Weather Bureau Library, Prof. C. F. Talman in charge.

forms, the amount, character, and location of any special or peculiar appearance in the distant horizon, as low bank of clouds * * * thunderstorm, sheet or hear lightning in W., SW., E., etc.

1882. Instructions for Voluntary Observers of the Signal Service, 1882, pages 87–88, says:

Thunderstorms.—The time of beginning and ending of the storm must be indicated as exactly as possible; the point of the horizon whence it rises, the direction of the clouds, of the wind and its variations, and, if possible, the quantity of rain before and during the storm; of hail, etc., which falls; note if it passes over the place of observation, or at a distance; if it is accompanied, or not, with strong electrical detonations and numerous lightnings. It will be well to ascertain the state of the meteorological instruments every five minutes during the storm, especially of the barometer and the thermometer. [This is identical with a paragraph appearing in Directions for Meteorological Observations, published by the Smithsonian Institution, Washington, 1872, pp. 31–32.]

On page 103 of the above-mentioned Instructions for Voluntary Observers, in connection with instructions for filling up Form No. 122, appears the following:

Note observations of the following:
Thunderstorms: Time of occurrence and direction of motion. Distant thunder, without visible lightning * * * Lightning at a distance: Time of occurrence, direction from observer, whether zigzag, forked, or diffused.

1884. During the summer of 1884 *a special effort was made to collect thunderstorm data* for that summer. In this connection was issued Signal Service Circular No. 4, March 1, 1884. The following extracts are taken from that circular:

It is desired that during the summer of 1884 a few simple facts be collected relating to the important subject of thunderstorms. To this end post offices and other centers have been selected, over a limited extent of country, at distances of about 10 miles * * *. Each thunderstorm should have some note made of it, in order that there may be no gap in any region. * * *

Note also, if on any day heat lightning is seen, the date, time of appearance, and direction.

* * * Please do not fail to make some note of every distinct thunderstorm that passes over, or within earshot of, the station.

Signal Service General Orders, No. 47, May 12, 1884, contains the following:

The following will be inserted in the Instructions to Observers, etc., after paragraph 130*a*:

130*b*. A storm from which distinct thunder is heard, though it may not pass over the station, and no rain may fall, will be considered a thunderstorm. Record thunderstorms in the journal, as far as possible, as follows:

Time of beginning and ending.
Direction from which the storm came and toward which it moved.

In this connection it may be of interest to note that in the introduction to the "Abstract of Journal" used by stations, which gives current instructions in condensed form, no specific mention is made of General Orders, No. 47, May 12, 1884 until *1894*. Prior to that date the volumes of the "abstract" contained the following directions in regard to thunderstorms: "The following will be recorded in accordance with existing instructions * * * thunderstorms * * *." A reference also was given, as follows: "Read carefully the general instructions to observers, pages 69 to 73." (This presumably refers to the instructions of 1887, in which, apparently, the definition of "thunderstorm" given in Order No. 47, 1884, does not appear.) *Beginning with the volume for 1894*, the "Abstract of Journal" contains the following: "*Whenever thunder is distinctly heard it will be recorded as a thunderstorm, whether or nor lightning is seen or rain falls at the station. See General Orders, No. 47, 1884.*"

It is very desirable to find out what thunderstorm instructions were given in the early numbers of Form 1001. These instructions appear not to be available in the bound files of these forms at this office, as the covers, which it is thought contained the thunderstorm instructions, were removed before binding.

1887. General Instructions to Observers of the Signal Service, 1887, page 70, contains the following brief directions in regard to thunderstorms:

Thunderstorms, how recorded.—Record thunderstorms as follows:
Time of beginning and ending.
Direction from which the storm came and toward which it moved.
Temperature, and direction of wind, both before and after the storm.
Hail: Time of beginning and ending, and size of hailstones.

Signal Office, General Orders, No. 19, April 14, 1887, page 6, contains the following reference to thunderstorms in connection with entries in the "Abstract of Journal":

* * * To facilitate reference, marginal notes will be made in red ink at the left of the vertical line on each page upon the prominent subjects mentioned in the text, as "Aurora," "Rain," * * * "Thunderstorms * * *."

1892. During the summer of 1892 another special effort was made (see 1884) to collect thunderstorm data, and for this purpose a circular, dated April 1, 1892, was issued by the Weather Bureau. (See Weather Bureau Bulletin No. 9: N. B. Conger, Report on the Forecasting of Thunderstorms, Washington, 1893, pp. 9–10.) This circular gives detailed instructions for recording thunderstorms, from which the following is quoted:

Thunder.—Record should be made whenever a thunderstorm can be seen or heard. Thunder without rainfall should be noted, and in such cases care should be taken to state that no rain fell.

1893. Executive Division Circular Letter No. 25, 1893, Instructions for Enciphering Beginning and Ending of Thunderstorms, was issued by the Weather Bureau May 15, 1893, apparently for the purpose of explaining the use of the Thunderstorm Cipher Code, "in transmitting, in regular reports, the time of beginning and ending of thunderstorms * * * during the months of June, July, and August." Quoting further from this circular:

The FIRST THUNDER heard will establish the time of BEGINNING; and the ENDING OF PRECIPITATION, the time of ENDING. * * *

A thunderstorm in the immediate vicinity of station will be reported, even though there is no precipitation at the station. The first thunder heard will determine the beginning, and the ending can be approximated.

1895. Instructions for Observers of the Weather Bureau, 1895, page 22, contains the following in regard to thunderstorms:

In recording thunderstorms, the following wording will be used: First thunder heard at ———; loudest at ———; last at ———; storm came from the ——— and moved toward the ———; temperature before the storm, ———; after. ———; direction of the wind before the storm, ——— after, ———; [etc.].

The following instructions (General Order No. 47, Signal Office), issued on May 12, 1884—

A storm from which distinct thunder is heard, though it may not pass over the station, and no rain may fall, will be considered a thunderstorm,

and the instructions issued January, 1894—

A day with thunderstorm is one on which thunder is distinctly heard at the station during the day, whether or not lightning is seen or rain falls at the station,

are essentially identical and have been in force ever since. They therefore governed during the period covered by the charts and most of the tabular matter. As stated, greater care has been exercised of late years in carrying out instructions, especially as to storms occurring at night, and therefore the later records are more reliable, certainly, than those of the earliest years of the service.

GENERAL DISTRIBUTION OF THUNDERSTORMS.

In regard to the more general distribution of the thunderstorms over the world, the following from Prof. Milham's Meteorology, page 326, may be of interest:

Thundershowers occur in nearly every part of the world, but the number decreases rapidly from the Equator toward the pole. Within the Tropics there are many places where there are nearly 200 days in the course of a year with thundershowers. The number of days with thundershowers decreases rapidly with latitude, until in the polar regions but one or two thundershowers in the course of several years may be recorded. Fewer thundershowers occur over the ocean than over the land, and mountainous regions have far more than level country.

Along this same line, Prof. Humphreys says (op. cit., p. 352):

* * * From the nature of its formation one would assume, and the assumption is supported by observation, that the thunderstorm must be rare beyond either polar circle, especially over Greenland and over the Antarctic Continent, rare over great desert regions wherever situated, and, on the other hand, increasingly abundant with increase of temperature and humidity, and therefore in general most abundant in the more rainy portions of the equatorial regions.

In regard to the distribution of thunderstorms over the United States, Prof. A. J. Henry, in Bulletin Q, page 76, says:

That part of the United States in which thunderstorms occur most frequently lies east of the Rocky Mountains and south of about the forty-second parallel of latitude. * * * There are two regions of maximum annual frequency (50 days or over), the first in Florida and the East Gulf States, and the second in the lower Missouri Valley. The regions of least frequency (15 days or less) are along the New England coast, the northern portion of the Lake Region, the Plateau Region, and the Pacific coast.

The general belief that thunderstorms do not occur on the Pacific coast is not well founded. It is true that they are of infrequent occurrence along the immediate coast and in the lowlands, but they are quite frequent on the higher levels, both of the Coast Range and the Sierra Nevada. The region of maximum frequency west of the Rocky Mountains lies in Arizona, southern Utah, and southwestern Colorado, where thunderstorms occur, on the average of the year, on upward of 20 days. Except on the higher levels, many thunderstorms in the above-named States are rainless. In fact, it is not uncommon in the arid regions of the Southwest to witness a thunderstorm in progress, the rain from which evaporates in the extremely hot and dry air before it reaches the earth.

In this connection I reproduce some words by Mr. John Muir, because they introduce a sort of tragic side light on the more general theme of the thunderstorm. He is writing about the Big Trees—the Sequoia—of California, in the Atlantic Monthly for September, 1901. I take his words as quoted in Bulletin L, Climatology of California, pages 252–253.

Most of the Sierra trees die of disease. Thus the magnificent silver firs are devoured by fungi, and comparatively few of them live to see their hundredth birth year. But nothing hurts the Big Tree. I never saw one that was sick or showed the slightest sign of decay. It lives on through indefinite thousands of years, until burned, blown down, undermined, or shattered by some tremendous lightning stroke. No ordinary bolt ever seriously hurts Sequoia. In all my walks I have seen only one that was thus killed outright.

Lightning, though rare in California lowlands, is common on the Sierra. Almost every day in June and July small thunderstorms refresh the main forest belt. Clouds, like snowy mountains of marvelous beauty, grow rapidly in the calm sky about midday and cast cooling shadows and showers that seldom last more than an hour. Nevertheless, these brief, kind storms wound or kill a good many trees. I have seen silver firs 200 feet high split into long peeled rails and slivers down to the roots, leaving not even a stump, the rails radiating like the spokes of a wheel from a hole in the ground where the tree stood. But the Sequoia, instead of being split and slivered, usually has 40 or 50 feet of its brash, knotty top smashed off in short chunks about the size of cord wood, the beautiful rosy-red ruins covering the ground in a circle 100 feet wide or more.

I never saw any that had been cut down to the ground, or even to below the branches, except one in the Stanislaus Grove, about 12 feet in diameter, the greater part of which was smashed to fragments, leaving only a leafless stump about 75 feet high. It is a curious fact that all the very old Sequoia have lost their heads by lightning. "All things come to him who waits," but of all living things Sequoia is perhaps the only one able to wait long enough to make sure of being struck by lightning. Thousands of years it stands ready and waiting, offering its head to every passing cloud as if inviting its fate, praying for heaven's fire as a blessing, and when at last the old head is off another of the same shape immediately begins to grow on.

But to return to our charts. I shall not enter into a detailed discussion of these, but merely point out some of the most obvious points of interest.

December.—The month of December has fewer thunderstorms than any other month, and I will begin with the December chart, No. 12 (XLIII–82). The first point we note is that the center of greatest activity during this month lies along the middle Gulf coast; north of a line drawn from southern Maine, diagonally across the country to southern California, practically no storms occur. Eastern Ohio, the central and northern portions of Virginia, most of Maryland and Delaware, also seem to be immune from thunderstorms in this month. South of this line the average is about one thunderstorm per month in the Gulf States, except along the east Texas and Louisiana coasts, where the average is about two per month. It is interesting, possibly surprising, to see over what a large portion of the country not a single thunderstorm was recorded during the 10 years under consideration.

January.—Passing to the January chart we note that the northern limit of thunderstorms lies considerably further north and that the center of activity has apparently moved a little inland, while the number of storms has increased quite generally over the lower Mississippi Valley. We note, however, that northern Virginia still seems to be immune while considerable activity is shown in northern Utah in the vicinity of Great Salt Lake.

February.—In February the northern limit is practically the same as in January, but there is a perceptible increase in the number of storms over the lower Mississippi Valley and eastward to the Atlantic coast. The center of greatest activity is still over the middle Gulf States but with a tendency to move northward. Thunderstorms continue relatively rare in the Appalachian Mountain districts north of North Carolina.

March.—The chart for the month of March reveals the fact that thunderstorms are very rare north and west of a line drawn from Lake Superior to El Paso, Tex., and that only very small areas are immune. Apparently the greater portion of Wyoming and possibly limited areas in the Far Northwest are nearly free from these phenomena. We notice, however, that there is now a marked increase in the number over all south-central and eastern districts. The center of greatest activity seems now to be over Tennessee and Kentucky, with a secondary center where the primary center was in February. A third center appears over the northern part of New Mexico.

April.—Passing to the April chart, we note a still further increase in storm frequency over the whole country, but especially over the Middle and Southern Plains States. A decided shift to the southwest has occurred in the center of greatest activity which now lies over southern Arkansas, northern Louisiana, and northeast Texas. The increase in the number of thunderstorms over the Rocky Mountain regions is very pronounced. These storms have now become fairly frequent over the southern portions of the Great Lakes. Apparently the only parts of the country now free from these phenomena are the middle California coast in the vicinity of San Francisco, and southern Arizona in the vicinity of Yuma. These storms now occur along the entire Canadian border.

May.—The chart for May shows us at once that the frequency of these storms is increasing throughout the country, especially in the Rocky Mountain States, and that the area of maximum frequency has spread northward from Texas to Iowa, including portions of Arkansas, Oklahoma, Kansas, Missouri, and Illinois. There is also another center of great frequency over Florida, if indeed

it has not become the center of greatest frequency. The entire California coast north of Los Angeles seems to be free from thunderstorms during the month of May, and this is the only part of the country that is thus immune.

June.—Passing from the May to the June chart, the surprising feature is the great increase in the number of thunderstorms throughout the field, except along the Pacific coast. The area of maximum frequency now overlies the southeast, more particularly Florida, with a decided secondary over eastern Wyoming and western Nebraska. Within these areas of "maximum frequency" storms occur on the average about every third day, and on the west coast of Florida about every other day. The California coast is still immune north of Los Angeles and thunderstorms are less frequent over southern and southwestern Texas.

July.—As the December chart holds the record for the least number of thunderstorms, July holds the record for the greatest number, taking the country as a whole. We note that the area of maximum frequency is still over the southeast with a very marked secondary over the southwest, including the State of Colorado and portions of the adjoining States. Thunderstorms are now more frequent along the Mexican border. San Francisco and vicinity are apparently exempt while the mountainous portions of the country seem to be especially favorable for the development of these storms, which, however, is true also of the other summer months.

August.—On the chart for August (W. H. A.—8) we notice for the first time signs of diminishing activity in the development of these storms. The region of greatest frequency remains over the southeast but is more restricted, while the secondary that was over Colorado in July has dropped south and touches the Mexican border. The average is still quite high over the southern half of the country, especially Florida, but practically no storms of this kind occur in California in this month.

September.—The September chart reveals a very marked decrease in the number of storms, except along the Pacific coast, where a slight increase is noticed. The chief center of activity is along the east Gulf coast with a moderate secondary over the southwest. No part of the country, except possibly San Francisco and vicinity, seems to be immune, but they are very rare in southern Canada and along the Canadian border west of the Great Lakes.

October.—The October chart also shows a rapid diminution in the number of thunderstorms over the country, and especially east of the Mississippi River. These storms are now relatively most frequent in Florida and the Plains States south of Iowa. There seems to be no decrease in the number along the Pacific coast.

November.—The November chart seems to indicate that the northern limit of thunderstorms has made considerable progress southward over the Rocky Mountain States and the regions west of the Great Plateau, and that these storms are relatively few in all sections, the region of greatest frequency being now over the middle Mississippi Valley, where the average is from one to two per month. The interior portions of the Atlantic States north of Georgia are practically immune from these storms during this month, and even Florida is nearly free. Except in the vicinity of the Great Lakes Canada is now free from these storms.

Annual frequency.—Having discussed the December chart, we pass to figure 13 (XLIII–83), which covers the entire period from 1904 to 1913, inclusive. The figures represent the total number of thunderstorms recorded during those 10 years at the several stations, and therefore to ascertain a fairly good working average for the year at any particular station simply divide the number by 10. Observe that no part of the field is entirely free from these phenomena. We find two centers of great activity, one over Florida and the other over northern New Mexico. The first gathers about Tampa, Fla., with its 944 storms in 10 years, and the second about Santa Fe, N. Mex., with 710 to its credit. Tampa is a sea-level station, while Santa Fe is about 7,000 feet above the sea; the former is situated in what is perhaps the most humid portion of the United States, while the latter is in the arid regions. The contrast is very interesting and suggestive. The irregularity of the areas of thunderstorm frequency seems to suggest that local topography may enter as an important, possibly in some cases as a determining, factor in this problem. At any rate enough has been said, it is hoped, to demonstrate that the study of the thunderstorm is interesting from whatever angle one approaches it.

LOCAL CHARACTERS OF THUNDERSTORMS.

Some of the Weather Bureau officials were kind enough to send along with the tabular matter for the individual stations notes regarding the character of the thunderstorm in his particular locality, or of some historic storm. We offer a few of these as a part of this discussion.

Atlanta, Ga.—Thunderstorms at Atlanta are rarely of exceptional violence as regards the electrical display, but the outrushing winds are almost always very high, sometimes exceeding 60 miles per hour. For especially noteworthy thunderstorms at Atlanta, see MONTHLY WEATHER REVIEW, District No. 2, for October, 1910.—*C. F. Von Hermann, Section Director.*

Devils Lake, N. Dak.—Thunderstorms are rare in this district from November to March, inclusive. Old residents in this city, however, tell of a severe thunderstorm on January 1, in the early days, thus showing that it is possible for such a storm to develop.—*M. R. Hovde, Observer.*

[Mr. Hovde also points out the interesting fact that the year 1912, the wetest year (22.74 inches), had 34 thunderstorms, whereas 1913, the driest year (13.13 inches), had 40 thunderstorms.—W. H. A.]

Dubuque, Iowa.—A storm here in the valley moving northwestward is very unusual. Some of our storms are terrific, but as a rule they do little or no damage. I remember one a year or so ago which kept up all night (10 or 12 hours). One would think it impossible for one storm to cause so much "fireworks."—*J. H. Spencer, Local Forecaster.*

Grand Junction, Colo.—Severe thunderstorms are rare; the majority of the storms reported are light, in many cases one or a few peals only being heard. Excessive precipitation is practically unknown; the greatest amount recorded in one hour is 0.67 inch; the greatest in five minutes, 0.22 inch. Maximum wind velocity on record, 44 miles per hour.—*E. S. Nichols, Local Forecaster.*

Point Reyes Light, Cal.—The typical eastern thundercloud does not occur in this vicinity. Practically all of our few thunderstorms occur just after the passage of a low pressure area. Near the end of a storm and just before the wind shifts to the northwest, a special type of cumulo-nimbus often appears, and it is in connection with these clouds that our thunderstorms (often accompanied by hail) occur. Our thunderstorms are of short duration; often only a single peal of thunder.—*James Jones, Assistant Observer.*

Pueblo, Colo.—Thunderstorms unknown here in January and December.—*L. H. Daingerfield, Local Forecaster.*

[Pueblo is located on lat. 38° 18′ N.; long. 104° 36′ W.; elevation above sea level, 4,685 feet.—W. H. A.]

Rochester, N. Y.—Out of 742 thunderstorms recorded at this station, 27 were especially severe and more or less damaging from lightning. Ninety-five per cent of the storms were light or mild in character.—*L. M. Dey, Local Forecaster.*

Seattle, Wash.—With two or three exceptions the thunderstorms recorded at this station were light; nearly one-half of them were scarcely worthy of the name.—*G. N. Salisbury, Section Director.*

It is here appropriate to introduce the detailed tables of thunderstorm occurrences at those points in the United States which have served as the basis for the maps reproduced as charts W. H. A.—1 to 13 (XLIII–71 to 83). These figures have been contributed by the officials in charge of the respective stations. Mr. S. A. Potter of the Washington, D. C., station has computed the sums presented in the last two lines for each station. The sums in black-faced type are the values used in preparing the charts; beneath them are, in each case, the plain figures showing the total number of recorded thunderstorms since beginning of each record.

Number of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1915, inclusive.

Abilene, Taylor County, Tex.

[Lat., 32° 23′ N.; long., 99° 40′ W. Elevation, 1,738 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1886–1903....	5	12	49	91	121	115	87	84	47	26	19	13	669
1904.....	1	0	0	4	8	5	3	7	4	1	1	0	34
1905.....	2	0	2	2	6	4	6	3	0	3	1	0	29
1906.....	0	0	0	0	8	5	5	2	7	1	0	0	28
1907.....	2	0	3	2	5	3	3	2	2	1	0	1	24
1908.....	0	0	1	6	6	3	11	3	2	3	3	0	38
1909.....	0	0	1	2	9	7	3	3	1	3	2	0	31
1910.....	0	2	2	4	6	8	5	8	5	2	0	1	43
1911.....	0	1	3	7	3	2	13	6	2	2	0	1	40
1912.....	0	1	2	7	6	2	4	7	3	4	0	1	37
1913.....	1	1	1	2	7	1	4	10	4	1	3	0	35
1904–13.....	**6**	**5**	**15**	**36**	**64**	**40**	**57**	**51**	**30**	**21**	**10**	**4**	**339**
1886–1913....	11	17	64	127	185	155	144	135	77	47	29	17	1,008

Amarillo, Potter Co., Tex.

[Lat., 35° 13′ N.; long., 101° 50′ W. Elevation, 3,676 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1892–1903....	2	1	3	33	78	96	96	102	55	27	6	0	499 44
1904.....	0	0	0	6	4	6	8	9	8	3	0	0	47
1905.....	0	0	4	8	9	6	9	8	1	1	1	0	40
1906.....	0	0	1	1	6	7	10	8	6	0	1	0	35
1907.....	1	1	0	2	8	5	5	8	3	2	0	0	34
1908.....	0	0	0	3	5	9	6	8	1	1	1	0	31
1909.....	0	0	1	1	7	14	2	3	1	1	1	0	25
1910.....	0	0	1	3	5	5	5	6	0	0	0	0	30
1911.....	0	0	1	3	5	4	9	4	3	1	0	0	36
1912.....	0	1	1	2	4	6	9	5	7	1	0	0	34
1913.....	0	0	1	3	7	3	5	8	4	1	1	1	
1904–13.....	**1**	**2**	**10**	**32**	**60**	**65**	**68**	**67**	**34**	**11**	**5**	**1**	**356**
1892–1913....	3	3	13	65	138	161	164	169	89	38	11	1	855

Atlantic City, Atlantic County, N. J.

[Lat., 39° 22′ N.; long., 74° 25′ W. Elevation, 52 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1874–1903....	2	9	20	32	70	80	104	88	37	10	4	1	457
1904.....	0	0	0	2	3	4	5	4	1	0	0	0	19
1905.....	0	0	1	3	5	6	3	3	2	0	0	0	23
1906.....	0	0	2	0	2	7	7	8	4	5	0	0	35
1907.....	0	0	3	2	4	3	5	7	5	3	1	0	33
1908.....	0	0	1	3	3	3	7	2	2	1	0	0	22
1909.....	0	1	0	5	3	4	5	1	0	2	1	0	22
1910.....	0	2	0	3	4	5	6	4	1	0	0	0	25
1911.....	0	0	4	0	3	8	8	9	1	0	1	0	34
1912.....	0	2	2	5	3	4	9	3	3	2	0	0	33
1913.....	1	0	1	7	3	7	5	9	3	2	0	2	40
1904–1913....	**1**	**5**	**14**	**30**	**33**	**51**	**60**	**50**	**22**	**15**	**3**	**2**	**286**
1874–1913....	3	14	34	62	103	131	164	138	59	25	7	3	743

Atlanta, Fulton County, Ga.

[Lat., 33° 45′ N.; long., 84° 23′ W. Elevation, 1,174 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884–1903 [1]...	11	22	50	57	102	149	173	148	23	15	17	6	773
1904.....	1	1	4	3	4	9	18	18	3	0	0	0	61
1905.....	1	0	5	7	13	13	16	14	5	1	1	0	76
1906.....	1	0	2	2	2	13	14	20	13	0	0	0	67
1907.....	0	0	3	6	9	8	16	14	5	0	2	2	65
1908.....	1	0	3	5	10	10	14	12	2	2	0	0	59
1909.....	0	6	6	4	7	14	9	11	5	2	2	0	66
1910.....	1	2	4	2	7	8	19	9	8	0	1	0	61
1911.....	0	1	1	4	8	5	15	10	9	1	1	0	55
1912.....	0	1	2	6	8	9	16	10	3	1	0	0	56
1913.....	1	2	5	1	6	15	16	10	3	1	0	0	60
1904–1913....	**6**	**13**	**35**	**40**	**74**	**104**	**153**	**128**	**56**	**8**	**7**	**2**	**626**
1884–1913....	17	35	85	97	176	253	326	276	79	23	24	8	1,399

[1] Record for 1890 missing.

Augusta, Richmond County, Ga.

[Lat., 33° 28′ N.; long., 81° 54′ W. Elevation, 180 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1875–1903....	7	20	47	64	128	187	199	164	50	11	8	11	896
1904.....	1	1	2	1	5	8	16	13	3	0	0	0	50
1905.....	0	0	9	4	5	8	8	8	3	0	1	0	46
1906.....	1	0	0	4	5	12	12	16	8	0	1	1	61
1907.....	0	1	2	4	9	8	17	12	9	0	1	0	63
1908.....	1	0	3	6	9	9	16	9	0	1	0	0	54
1909.....	1	5	4	2	8	9	9	9	3	3	2	0	55
1910.....	2	3	2	2	4	11	13	6	6	1	1	0	51
1911.....	0	0	1	1	3	12	11	16	5	3	0	1	53
1912.....	0	2	1	4	5	5	11	7	4	1	1	0	41
1913.....	1	2	5	2	6	11	13	12	4	0	1	1	58
1904–1913....	**7**	**14**	**29**	**30**	**59**	**93**	**127**	**108**	**45**	**9**	**8**	**3**	**532**
1875–1913....	14	34	76	94	187	280	326	272	95	20	16	14	1,428

Baker, Baker County, Oreg.

[Lat., 44° 46′ N.; long., 117° 50′ W. Elevation, 3,471 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1891–1903....	1	0	0	5	26	37	27	28	13	1	2	1	141
1904.....	0	0	0	1	2	1	8	4	2	1	0	0	19
1905.....	0	0	0	2	2	4	2	0	0	0	[2] 0	[2] 0	10
1906.....	0	0	0	0	3	5	4	4	0	0	0	0	16
1907.....	0	0	0	1	5	5	12	1	3	0	0	0	27
1908.....	0	0	0	2	1	4	5	4	6	0	0	0	22
1909.....	0	0	0	0	1	3	5	1	4	1	0	0	15
1910.....													
1911.....	[2] 0	[2] 0	0	1	0	0	2	3	3	1	0	0	19
1912.....	0	0	0	0	1	7	6	4	0	0	0	0	18
1913.....	0	0	0	0	5	9	4	6	1	0	0	0	25
1904–1913....	**0**	**0**	**0**	**7**	**20**	**47**	**48**	**27**	**19**	**3**	**0**	**0**	**171**
1891–1913....	1	0	0	12	46	84	75	55	32	4	2	1	312

Baltimore, Baltimore County, Md.

[Lat., 39° 17′ N.; long., 76° 37′ W. Elevation, 123 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1876–1903....	3	11	20	33	107	156	179	111	43	7	6	2	678
1904.....	0	1	1	2	6	8	7	3	3	0	0	0	31
1905.....	0	0	2	6	6	4	13	7	0	1	0	0	39
1906.....	0	2	1	3	3	8	9	6	1	0	0	0	33
1907.....	1	0	3	2	4	3	11	6	7	1	1	0	39
1908.....	1	0	3	1	6	1	13	3	2	1	0	0	31
1909.....	0	0	0	0	2	7	2	0	0	0	0	0	11
1910.....	0	1	1	2	5	6	3	2	3	0	0	0	23
1911.....	0	0	2	0	4	10	9	13	2	0	0	0	40
1912.....	0	1	3	7	6	4	9	4	6	1	0	0	41
1913.....	0	1	3	6	3	3	9	7	3	2	0	0	37
1904–1913....	**2**	**6**	**19**	**29**	**45**	**54**	**85**	**51**	**27**	**6**	**1**	**0**	**325**
1876–1913....	5	17	39	62	152	210	264	162	70	13	7	2	1,003

Bismarck, Burleigh County, N. Dak.

[Lat., 46° 47′ N.; long., 100° 38′ W. Elevation, 1,674 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1888–1903....	0	1	0	14	45	109	111	72	31	6	0	0	389
1904.....	0	0	0	0	2	8	6	3	0	1	0	0	20
1905.....	0	0	0	1	2	5	7	5	4	0	0	0	24
1906.....	0	0	0	1	5	8	5	3	4	1	0	0	27
1907.....	0	0	0	0	2	9	13	7	5	1	0	0	37
1908.....	0	0	0	1	2	4	4	8	2	2	0	0	23
1909.....	0	0	0	0	8	9	7	11	0	2	0	0	37
1910.....	0	0	0	1	2	7	5	8	3	2	0	0	28
1911.....	0	0	0	2	8	7	3	5	4	1	0	0	30
1912.....	0	0	0	3	8	3	6	6	2	0	0	0	28
1913.....	0	0	0	2	2	7	8	8	3	1	0	0	31
1904–1913....	**0**	**0**	**0**	**11**	**41**	**67**	**64**	**64**	**27**	**11**	**0**	**0**	**285**
1888–1913....	0	1	0	25	86	176	175	136	58	17	0	0	674

[2] Interpolated values.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Block Island, Newport County, R. I													
[Lat., 41° 10′ N.; long., 71° 36′ W. Elevation, 26 feet.]													
1889–1903....	2	3	6	5	19	27	34	37	21	5	2	2	163
1904.....	0	0	0	2	3	4	3	6	2	0	0	0	20
1905.....	0	0	0	4	3	1	7	5	2	0	1	0	23
1906.....	0	0	0	1	2	3	2	3	5	1	1	0	18
1907.....	0	0	3	4	4	3	2	1	4	0	1	0	22
1908.....	0	0	4	0	0	4	4	1	0	0	1	0	14
1909.....	0	0	0	3	6	2	5	1	1	0	0	0	18
1910.....	0	1	2	1	3	2	4	2	0	3	0	0	18
1911.....	0	1	1	0	0	4	4	5	1	1	1	0	18
1912.....	0	1	2	1	3	2	5	1	2	1	1	0	19
1913.....	1	2	2	4	0	2	3	5	2	2	0	0	23
1904–1913....	**1**	**5**	**14**	**20**	**24**	**27**	**39**	**30**	**19**	**8**	**6**	**0**	**193**
1889–1913....	3	8	20	25	43	54	73	67	40	13	8	2	356
Boston, Suffolk County, Mass.													
[Lat., 42° 21′ N.; long., 81° 4′ W. Elevation, 125 feet.]													
1885–1903....	2	3	3	7	25	36	65	50	26	3	4	0	224
1904.....	1	0	2	1	4	5	3	3	4	0	0	0	23
1905.....	0	0	0	2	2	4	4	6	1	0	0	0	19
1906.....	0	0	0	0	4	4	4	6	2	1	0	0	21
1907.....	0	0	0	1	1	2	4	0	5	0	0	0	13
1908.....	0	0	1	3	0	4	5	4	0	0	0	0	17
1909.....	1	0	1	0	2	2	3	2	1	0	0	0	12
1910.....	0	0	1	0	1	3	3	3	1	2	0	0	14
1911.....	0	0	1	0	2	4	3	4	1	0	1	0	16
1912.....	0	1	0	1	6	1	6	6	1	0	1	0	23
1913.....	0	0	2	1	2	1	6	6	2	1	0	1	22
1904–1913....	**2**	**1**	**8**	**8**	**24**	**30**	**41**	**40**	**18**	**4**	**2**	**1**	**180**
1885–1913....	4	4	11	15	49	66	106	90	44	7	6	1	404
Buffalo, Erie County, N. Y.													
[Lat., 42° 53′ N.; long., 78° 53′ W. Elevation, 767 feet.]													
1874–1903....	4	3	20	40	86	120	152	114	60	34	10	4	647
1904.....	0	2	3	1	3	9	8	6	2	3	1	0	38
1905.....	0	0	1	0	5	7	11	5	2	1	0	0	32
1906.....	0	0	0	1	7	10	5	8	5	2	1	0	39
1907.....	2	0	3	0	4	4	7	1	8	1	1	0	31
1908.....	0	1	3	1	6	4	8	6	3	1	0	0	33
1909.....	0	0	0	3	6	2	7	3	2	1	0	0	24
1910.....	0	0	2	0	5	1	8	7	2	3	1	0	29
1911.....	0	0	2	1	6	5	7	9	2	0	0	0	32
1912.....	0	0	0	3	6	3	3	6	5	0	3	0	29
1913.....	0	0	2	5	2	8	5	5	0	1	0	0	28
1904–1913....	**2**	**3**	**16**	**15**	**50**	**53**	**69**	**56**	**31**	**13**	**7**	**0**	**315**
1874–1913....	6	6	36	55	136	173	221	170	91	47	17	4	962
Charleston, Charleston County, S. C.													
[Lat., 32° 47′ N.; long., 79° 56′ W. Elevation, 48 feet.]													
1871–1903....	21	35	58	91	180	323	379	340	117	46	29	20	1,639
1904.....	4	1	8	7	7	13	25	18	6	0	1	2	92
1905.....	0	1	2	6	15	5	17	12	8	0	0	2	68
1906.....	1	1	3	2	4	12	16	18	7	3	0	0	67
1907.....	0	3	2	6	6	12	15	19	9	1	0	1	74
1908.....	1	2	1	6	9	11	8	12	3	1	3	1	58
1909.....	0	3	3	3	8	9	10	9	6	2	3	0	56
1910.....	0	3	0	3	5	10	12	9	8	1	1	0	52
1911.....	0	0	1	2	2	12	13	10	12	1	1	0	54
1912.....	0	3	0	6	5	2	10	8	12	2	0	0	48
1913.....	0	5	4	2	5	12	16	12	7	0	2	0	65
1904–1913....	**6**	**22**	**24**	**43**	**66**	**98**	**142**	**127**	**78**	**11**	**11**	**6**	**634**
1871–1913....	27	57	82	134	246	421	521	467	195	57	40	26	2,273

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Charlotte, Mecklenburg County, N. C.													
[Lat., 35° 13′ N.; long., 80° 51′ W. Elevation, 773 feet.]													
1879–1903....	6	16	44	82	167	209	211	185	48	14	8	6	996
1904.....	0	2	2	2	6	9	15	11	2	2	0	0	51
1905.....	0	0	2	6	7	3	11	8	2	0	0	0	39
1906.....	1	0	1	4	7	13	12	12	6	1	2	0	59
1907.....	0	0	1	4	4	12	16	9	6	1	0	1	54
1908.....	1	0	3	3	5	7	14	14	1	1	0	0	49
1909.....	0	4	1	4	6	13	12	7	2	3	1	0	53
1910.....	0	1	3	2	7	10	16	9	6	1	0	1	56
1911.....	0	1	2	3	3	12	10	10	6	0	0	0	47
1912.....	0	2	1	3	8	10	11	9	2	0	1	0	47
1913.....	1	0	5	3	11	17	13	9	2	1	1	0	63
1904–1913....	**3**	**10**	**21**	**34**	**64**	**106**	**130**	**98**	**35**	**10**	**5**	**2**	**518**
1879–1913....	9	26	65	116	231	315	341	283	83	24	13	8	1,514
Chattanooga, Hamilton County, Tenn.													
[Lat., 35° 4′ N.; long., 85° 14′ W. Elevation, 762 feet.]													
1879–1903....	12	43	79	120	193	254	292	239	79	32	20	6	1,369
1904.....	1	1	11	3	9	14	16	18	3	1	0	1	78
1905.....	0	0	3	6	8	13	11	10	6	0	0	0	57
1906.....	1	0	3	3	3	13	13	20	18	0	1	0	75
1907.....	2	0	5	6	8	12	12	13	6	0	4	0	86
1908.....	2	1	3	3	7	10	18	13	5	0	2	0	46
1909.....	1	5	7	9	7	17	10	12	5	2	2	1	87
1910.....	0	1	4	4	11	15	20	10	12	0	3	1	18
1911.....	0	3	3	4	5	14	13	12	10	1	0	0	56
1912.....	0	3	0	6	7	13	11	13	5	0	0	1	95
1913.....	1	3	4	0	9	14	14	8	1	2	0	0	65
1904–1913....	**8**	**17**	**43**	**44**	**74**	**135**	**138**	**129**	**71**	**6**	**12**	**4**	**681**
1879–1913....	20	60	122	164	267	389	430	368	150	38	32	10	2,050
Cheyenne, Laramie County, Wyo.													
[Lat., 41° 8′ N.; long., 104° 48′ W. Elevation, 6,088 feet.]													
1882–1903 [a]...	0	0	6	33	98	136	161	134	41	6	1	0	616
1904.....	0	0	1	3	12	17	18	14	4	1	0	0	70
1905.....	0	0	0	2	12	14	17	15	3	0	0	0	63
1906.....	0	0	0	3	7	7	16	11	9	1	0	0	54
1907.....	0	0	0	0	7	10	17	15	6	0	0	0	55
1908.....	0	0	0	2	9	13	15	10	1	1	0	0	51
1909.....	0	0	0	1	6	16	11	12	5	2	0	0	53
1910.....	0	0	0	1	7	11	13	9	8	0	0	0	49
1911.....	0	0	0	2	4	9	7	9	5	0	0	0	36
1912.....	0	0	0	1	1	10	15	10	6	1	0	0	44
1913.....	0	0	1	10	10	12	11	7	2	0	0	0	53
1904–1913....	**0**	**0**	**2**	**25**	**75**	**119**	**140**	**112**	**49**	**6**	**0**	**0**	**528**
1882–1913....	0	0	8	58	173	255	301	246	90	12	1	0	1,141
Chicago, Cook County, Ill.													
[Lat., 41° 53′ N.; long., 87° 37′ W. Elevation, 595 feet.]													
1871–1903....	5	7	31	77	148	166	149	120	76	33	13	3	828
1904.....	0	1	5	3	4	8	11	7	7	5	0	0	51
1905.....	0	0	4	4	8	11	8	5	5	2	0	0	47
1906.....	2	2	0	3	3	7	4	7	4	0	0	0	32
1907.....	2	0	5	3	5	7	7	7	5	2	0	0	43
1908.....	0	1	5	3	7	7	8	5	3	0	2	0	41
1909.....	2	1	0	5	4	8	3	7	2	0	2	0	34
1910.....	0	0	3	4	4	2	7	3	5	1	2	0	31
1911.....	0	0	0	4	6	6	7	7	10	3	1	0	44
1912.....	0	0	0	2	14	7	8	9	5	3	1	0	49
1913.....	0	0	4	1	4	3	5	7	2	1	1	0	28
1904–1913....	**6**	**5**	**26**	**32**	**59**	**66**	**68**	**64**	**48**	**17**	**9**	**0**	**400**
1871–1913....	11	12	57	109	207	232	217	184	124	50	22	3	1,228

[a] Record for 1886 and 1887 incomplete.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Cincinnati, Hamilton County, Ohio.

[Lat., 39° 6′ N.; long., 84° 30′ W. Elevation, 628 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884–1903....	5	17	33	49	113	138	105	113	47	17	10	2	649
1904.....	0	1	6	1	7	10	6	3	2	2	0	1	39
1905.....	0	0	1	4	11	8	9	10	4	1	0	0	48
1906.....	1	1	0	3	6	9	10	10	7	0	0	0	47
1907.....	1	0	2	4	5	8	11	4	5	1	1	0	42
1908.....	0	1	4	2	7	6	10	3	1	0	0	0	34
1909.....	1	2	0	7	4	10	6	10	1	3	2	0	46
1910.....	0	0	2	2	4	4	12	2	9	2	2	0	39
1911.....	3	0	3	4	8	11	11	3	8	5	2	0	58
1912.....	0	0	1	7	8	12	13	10	5	0	0	0	56
1913.....	0	0	5	2	6	9	12	8	3	1	1	0	47
1904–1913....	**6**	**5**	**24**	**36**	**66**	**87**	**100**	**63**	**45**	**15**	**8**	**1**	**456**
1884–1913....	11	22	57	85	179	225	205	176	92	32	18	3	1,105

Cleveland, Cuyahoga County, Ohio.

[Lat., 41° 30′ N.; long., 81° 42′ W. Elevation, 762 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884–1903....	4	8	23	32	113	133	141	94	58	21	6	1	63
1904.....	0	3	4	2	5	3	14	4	4	0	0	0	39
1905.....	0	0	0	3	10	3	8	6	4	4	0	0	38
1906.....	1	0	0	4	7	9	8	12	4	1	0	0	46
1907.....	1	0	3	1	4	10	9	1	5	2	0	0	36
1908.....	0	0	3	4	8	8	8	7	3	1	0	0	42
1909.....	1	0	0	5	7	10	4	8	4	0	1	0	40
1910.....	0	0	2	1	4	3	6	3	6	3	1	0	29
1911.....	0	0	1	1	7	5	4	7	5	2	0	0	33
1912.....	0	1	0	3	5	5	12	7	5	2	1	0	41
1913.....	1	0	2	4	3	8	10	6	2	5	0	0	41
1904–1913....	**4**	**4**	**15**	**28**	**60**	**64**	**83**	**61**	**42**	**20**	**3**	**0**	**381**
1884–1915....	8	12	38	60	173	197	224	155	100	41	9	1	1,018

Columbus, Franklin County, Ohio.

[Lat., 39° 58′ N.; long., 83° 00′ W. Elevation, 774 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1879–1903....	5	12	35	67	139	173	141	116	54	20	15	2	779
1904.....	0	1	5	1	6	8	11	7	4	3	0	1	47
1905.....	0	0	1	6	8	10	7	5	3	0	1	0	41
1906.....	1	0	0	4	7	8	13	12	3	1	0	0	49
1907.....	0	0	4	3	4	11	9	2	4	0	0	0	37
1908.....	0	1	7	2	7	6	11	4	1	0	0	0	39
1909.....	1	2	0	4	7	10	6	8	3	0	3	0	44
1910.....	1	0	2	4	4	8	8	5	11	2	3	0	48
1911.....	2	1	2	4	8	7	9	7	8	3	2	0	53
1912.....	0	0	1	6	9	7	14	13	3	0	0	0	53
1913.....	2	0	5	1	5	8	12	5	6	1	0	0	45
1904–1913....	**7**	**5**	**27**	**35**	**65**	**83**	**100**	**68**	**46**	**10**	**9**	**1**	**456**
1879–1913....	12	17	62	102	204	256	241	184	100	30	24	3	1,235

Columbia, Boone County, Mo.

[Lat., 38° 57′ N.; long., 92° 20′ W. Elevation, 784 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1890–1903....	10	12	31	75	129	161	123	105	75	31	19	5	776
1904.....	1	2	6	5	7	10	10	8	4	1	0	1	55
1905.....	0	0	4	6	12	8	8	15	6	3	2	0	64
1906.....	1	2	2	5	8	7	5	12	7	1	1	1	52
1907.....	4	0	3	5	6	14	13	9	6	2	0	0	62
1908.....	0	0	4	6	7	14	8	8	4	0	7	0	58
1909.....	3	2	4	6	7	11	8	2	4	7	7	2	63
1910.....	0	0	1	5	7	10	13	6	9	1	0	0	52
1911.....	2	1	2	5	6	7	6	8	9	2	2	0	50
1912.....	0	1	1	7	9	8	12	14	6	5	1	0	64
1913.....	0	0	6	3	10	9	10	7	5	1	4	0	55
1904–1913....	**11**	**8**	**33**	**53**	**79**	**98**	**93**	**89**	**60**	**23**	**24**	**4**	**575**
1890–1913....	21	20	64	128	208	259	216	194	135	54	43	9	1,351

[4] Record for 1885 incomplete.

Columbia, Richland County, S. C.

[Lat., 27° 49′ N.; long., 97° 25′ W. Elevation, 351 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1888–1903....	4	14	35	47	86	139	114	136	33	16	7	6	637
1904.....	2	1	5	2	7	10	16	13	2	1	0	0	59
1905.....	0	0	1	7	6	5	11	12	4	0	1	0	47
1906.....	1	0	0	6	5	13	15	17	4	0	1	1	63
1907.....	0	1	3	3	8	9	12	12	6	2	1	0	57
1908.....	3	0	2	5	7	11	11	10	4	0	0	0	53
1909.....	0	4	2	2	7	11	7	5	2	3	0	0	43
1910.....	1	4	2	2	6	12	12	7	10	1	1	0	58
1911.....	0	0	4	4	5	14	10	17	7	2	0	1	64
1912.....	0	1	1	6	6	7	9	12	4	0	0	0	46
1913.....	1	1	5	3	6	12	15	7	2	0	1	1	54
1904–1913....	**8**	**12**	**25**	**40**	**63**	**104**	**118**	**112**	**45**	**9**	**5**	**3**	**544**
1888–1913....	12	26	60	87	149	243	232	248	78	25	12	9	1,181

Concordia, Cloud County, Kans.

[Lat., 39° 35′ N.; long., 97° 41′ W. Elevation, 1,376 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1885–1903 [4]...	0	2	18	61	123	128	129	123	49	31	5	0	669
1904.....	0	0	4	3	7	13	9	6	7	2	0	0	51
1905.....	0	0	1	4	6	15	10	6	4	2	1	0	49
1906.....	0	0	3	7	6	8	8	6	5	0	0	0	43
1907.....	0	1	0	0	4	7	7	8	10	1	0	0	38
1908.....	0	1	1	1	13	15	5	13	3	1	1	0	54
1909.....	0	1	1	3	7	14	12	4	8	3	1	0	54
1910.....	0	0	0	3	5	6	6	10	9	3	0	0	42
1911.....	0	2	4	4	2	5	12	9	5	1	0	0	44
1912.....	0	0	0	3	7	5	11	9	5	4	0	0	44
1913.....	0	0	1	4	10	4	5	5	4	2	1	0	36
1304–1913....	**0**	**5**	**15**	**32**	**67**	**92**	**85**	**76**	**60**	**19**	**4**	**0**	**455**
1885–1913....	0	7	33	93	190	220	214	199	109	50	9	0	1,124

Corpus Christi, Nueces County, Tex.

[Lat., 27° 49′ N.; long., 97° 25′ W Elevation, 8 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1887–1903 [5]...	5	15	25	37	55	49	40	47	49	22	18	3	365
1904.....	0	2	1	4	8	4	7	7	10	2	2	4	51
1905.....	0	0	3	4	4	4	3	1	6	0	1	1	27
1906.....	0	1	3	4	3	3	6	2	4	1	1	0	28
1907.....	0	1	0	2	6	0	6	4	5	0	1	0	25
1908.....	0	1	2	4	2	2	11	8	7	1	2	1	41
1909.....	0	0	2	3	9	2	1	7	3	2	0	0	29
1910.....	0	0	1	4	7	2	2	2	3	0	1	2	24
1911.....	0	0	3	4	4	3	1	0	5	3	1	0	24
1912.....	0	3	1	2	6	5	2	0	3	0	0	1	23
1913.....	1	1	1	2	4	5	1	7	6	2	1	1	32
**1904–13..... **	**1**	**9**	**17**	**33**	**53**	**30**	**40**	**38**	**52**	**11**	**10**	**10**	**304**
1887–1913....	6	24	42	70	108	79	80	85	101	33	28	13	669

Davenport, Scott, County, Iowa.

[Lat., 41° 30′ N.; long., 90° 38′ W. Elevation, 606 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1880–1903....	4	7	33	72	146	171	162	116	89	35	18	5	858
1904.....	0	0	5	1	3	6	9	8	11	2	0	0	45
1905.....	0	0	3	5	6	7	5	11	6	2	0	0	45
1906.....	2	0	2	3	11	7	7	10	5	1	0	0	48
1907.....	1	0	3	2	4	9	11	9	6	2	0	0	47
1908.....	0	1	3	4	9	8	9	7	1	0	3	0	45
1909.....	1	0	0	6	7	10	8	8	4	3	4	1	52
1910.....	0	0	2	3	5	3	6	6	7	0	0	0	32
1911.....	0	2	1	3	9	11	9	11	12	1	3	0	62
1912.....	0	0	0	2	9	9	11	5	3	4	1	0	44
1913.....	0	0	3	3	7	9	5	11	3	1	0	0	42
1904–1913....	**4**	**3**	**22**	**32**	**70**	**79**	**80**	**86**	**58**	**16**	**11**	**1**	**462**
1880–1913....	8	10	55	104	216	250	242	202	147	51	29	6	1,320

[5] Record for January, 1887, missing.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Denver, Denver County, Colo.

[Lat., 39° 45′ N.; long., 105° 0′ W. Elevation, 5,272 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884–1903....	0	1	4	24	101	164	185	174	42	5	0	0	700
1904.....	0	0	0	1	13	14	16	9	5	0	0	0	58
1905.....	0	0	3	1	12	11	16	9	5	0	0	0	57
1906.....	0	0	1	0	7	8	9	12	5	0	0	0	42
1907.....	0	0	0	1	7	9	12	6	4	1	0	0	40
1908.....	0	0	0	2	4	10	9	13	2	0	0	0	40
1909.....	0	0	1	0	8	13	16	10	4	0	0	0	52
1910.....	0	0	0	0	2	5	9	10	12	1	0	0	39
1911.....	0	0	2	2	6	5	5	7	4	0	0	0	31
1912.....	0	0	0	1	1	11	16	16	2	1	0	0	48
1913.....	0	0	0	4	7	11	12	14	10	2	0	0	60
1904–1913....	**0**	**0**	**7**	**12**	**67**	**97**	**120**	**106**	**53**	**5**	**0**	**0**	**467**
1884–1913....	0	1	11	36	168	261	305	280	95	10	0	0	1,167

Des Moines, Polk County, Iowa.

[Lat., 41° 35′ N.; long., 93° 37′ W. Elevation, 861 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1879–1903....	5	2	37	95	164	[a]196	183	147	91	58	13	5	996
1904.....	0	0	2	4	4	8	9	5	9	4	0	0	45
1905.....	0	0	2	1	9	14	6	11	5	3	0	0	51
1906.....	0	0	2	3	10	8	11	10	6	1	0	0	51
1907.....	2	0	1	1	5	8	18	9	7	4	0	0	55
1908.....	0	1	4	3	13	9	9	9	2	2	0	0	52
1909.....	0	0	3	9	7	13	8	4	5	4	2	0	55
1910.....	0	0	3	4	5	8	7	7	4	0	0	0	38
1911.....	0	2	0	7	7	4	7	8	10	4	1	0	50
1912.....	0	0	0	5	10	10	11	10	9	7	1	0	63
1913.....	0	0	2	5	12	8	4	9	5	4	0	0	49
1904–1913....	**2**	**3**	**19**	**42**	**82**	**90**	**90**	**82**	**62**	**33**	**4**	**0**	**509**
1879–1913....	7	5	56	137	246	286	273	229	153	91	17	5	1,505

Detroit, Wayne County, Mich.

[Lat., 42° 19′ 54″ N.; long., 83° 02′ 51″ W. Elevation, 730 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1871–1903....	3	6	28	55	151	179	185	126	73	36	5	1	848
1904.....	0	3	3	0	3	6	8	4	8	1	0	0	36
1905.....	0	0	1	1	7	7	9	4	2	0	1	0	32
1906.....	0	2	0	4	3	7	10	9	1	2	1	0	39
1907.....	2	0	2	2	2	9	5	1	5	2	0	0	30
1908.....	0	0	4	6	10	5	7	4	0	1	2	0	39
1909.....	3	0	0	7	3	6	6	9	3	0	2	0	39
1910.....	0	0	1	4	5	4	8	6	2	2	0	0	32
1911.....	0	1	1	1	9	5	6	4	5	5	0	0	37
1912.....	0	0	0	4	6	6	9	11	6	3	1	0	46
1913.....	0	0	1	3	4	7	9	7	3	1	0	0	35
1904–1913....	**5**	**6**	**13**	**32**	**52**	**62**	**77**	**59**	**35**	**17**	**7**	**0**	**365**
1871–1913....	8	12	41	87	203	241	262	185	108	53	12	1	1,213

Dodge City, Ford County, Kans.

[Lat., 37° 45′ N.; long., 100° 00′ W. Elevation, 2,490 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1876–1903....	0	3	19	69	145	169	109	139	50	35	4	2	804
1904.....	0	0	1	5	11	13	19	11	6	0	0	0	66
1905.....	0	0	3	1	5	4	8	5	2	0	1	0	29
1906.....	0	0	0	3	7	9	5	6	4	0	0	2	36
1907.....	0	0	1	2	2	10	7	6	8	3	0	0	39
1908.....	0	0	0	4	7	12	7	3	2	3	0	0	38
1909.....	0	0	2	1	5	11	11	9	4	1	1	0	45
1910.....	0	0	0	1	1	8	6	10	2	2	0	0	30
1911.....	1	0	1	4	7	3	8	7	2	1	1	0	35
1912.....	0	0	0	3	6	12	8	10	5	2	1	0	47
1913.....	0	0	0	1	6	7	9	4	4	2	1	0	34
1904–1913....	**1**	**0**	**8**	**25**	**57**	**89**	**83**	**71**	**39**	**14**	**5**	**2**	**399**
1876–1913....	1	3	27	94	202	258	257	210	89	49	9	4	1,203

[a] Record for June, 1883, missing

Dubuque, Dubuque County, Iowa.

[Lat., 42° 30′ N.; long., 90° 44′ W. Elevation, 698 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1873–1903 [b]..	3	7	35	65	147	177	181	123	94	44	9	3	888
1904.....	0	0	3	1	4	6	5	5	5	4	0	0	33
1905.....	0	0	4	5	6	11	11	11	6	2	0	0	56
1906.....	0	0	1	2	10	9	8	10	5	1	0	0	46
1907.....	1	0	2	1	4	7	13	7	7	3	0	0	45
1908.....	0	1	1	3	7	10	8	4	3	1	2	0	40
1909.....	1	0	1	6	6	8	5	8	4	1	2	0	42
1910.....	0	0	2	2	2	2	2	6	4	0	2	0	22
1911.....	0	1	0	3	7	8	6	11	9	3	2	0	50
1912.....	0	0	0	6	8	6	9	6	5	3	1	0	44
1913.....	0	0	2	2	5	5	7	8	6	2	1	0	38
1904–1913....	**2**	**2**	**16**	**31**	**59**	**72**	**74**	**76**	**54**	**20**	**10**	**0**	**416**
1873–1913....	5	9	51	96	206	249	255	199	148	64	19	3	1,304

Duluth, St. Louis County, Minn.

[Lat., 46° 47′ N.; long., 92° 6′ W. Elevation, 1,133 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1871–1903....	0	1	12	32	81	147	109	136	76	31	3	0	688
1904.....	0	0	0	0	2	5	5	5	2	0	0	0	19
1905.....	0	0	1	1	2	11	6	6	4	0	0	0	31
1906.....	0	0	0	1	7	8	6	6	2	0	0	0	30
1907.....	0	0	0	0	2	2	8	6	3	0	0	0	21
1908.....	0	0	0	0	5	9	7	3	6	0	0	0	30
1909.....	1	0	0	1	0	2	9	5	3	0	0	0	21
1910.....	0	0	1	0	3	5	11	6	2	1	0	0	29
1911.....	0	0	0	1	5	8	7	3	3	0	0	0	27
1912.....	0	0	0	2	9	4	7	4	5	1	0	0	32
1913.....	0	0	0	2	5	6	12	7	3	6	1	0	42
1904–1913....	**1**	**0**	**2**	**8**	**40**	**60**	**78**	**51**	**33**	**8**	**1**	**0**	**282**
1871–1913....	1	1	14	40	121	207	247	187	109	39	4	0	970

El Paso, El Paso County, Tex.

[Lat., 31° 47′ N.; long., 106° 30′ W. Elevation, 3,762 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884–1903....	2	3	3	9	18	57	122	107	52	19	3	0	395
1904.....	0	0	0	0	1	7	5	8	4	6	0	0	31
1905.....	0	1	0	1	2	7	7	12	2	0	1	0	33
1906.....	1	1	0	2	2	0	14	10	5	1	1	0	37
1907.....	0	0	0	1	2	2	6	13	6	4	1	0	35
1908.....	0	0	1	2	1	1	10	13	0	0	0	0	28
1909.....	0	2	0	0	0	6	9	8	3	1	1	0	30
1910.....	1	0	0	0	0	2	6	11	1	0	0	0	21
1911.....	0	0	0	1	3	4	12	4	4	3	0	0	31
1912.....	0	0	1	0	0	10	11	18	2	3	0	1	46
1913.....	0	1	0	3	1	8	8	9	6	0	0	0	36
1904–1913....	**2**	**5**	**2**	**10**	**12**	**47**	**88**	**106**	**33**	**18**	**4**	**1**	**328**
1884–1913....	4	8	5	19	30	104	210	213	85	37	7	1	723

Erie, Erie County, Pa.

[Lat., 42° 1′ N.; long., 80° 5′ W. Elevation, 658 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1883–1903....	5	7	10	31	106	127	131	106	64	31	7	3	628
1904.....	0	3	4	0	5	9	8	6	3	2	0	0	40
1905.....	0	0	1	1	5	6	9	5	5	5	1	0	38
1906.....	0	0	0	1	5	10	5	5	3	3	0	0	32
1907.....	1	0	3	1	4	4	7	3	7	2	0	1	33
1908.....	0	0	4	3	8	6	6	3	4	0	1	1	36
1909.....	1	0	0	6	6	6	5	4	2	1	0	0	31
1910.....	1	0	3	2	4	3	7	6	5	2	0	0	33
1911.....	1	0	1	1	6	9	6	11	6	1	0	0	42
1912.....	0	1	2	4	7	6	9	10	5	2	0	0	46
1913.....	0	0	1	3	3	12	5	7	3	3	0	0	37
1904–1913....	**4**	**4**	**19**	**22**	**53**	**71**	**67**	**60**	**43**	**21**	**2**	**2**	**368**
1883–1913....	9	11	29	53	159	198	198	166	107	52	9	5	996

[b] Record for 1894, 1895, and 1896 incomplete.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Eureka, Humboldt County, Cal.

[Lat., 40° 48′ N.; long., 124° 11′ W. Elevation, 62 feet.]

Year.	Jan	Feb.	Mar.	Apr.	Ma.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1887-1903....	1	7	4	1	4	1	1	3	2	1	4	11	40
1904.....	0	0	4	0	0	0	1	0	1	0	1	0	7
1905.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1906.....	1	1	1	0	0	0	0	0	0	0	0	0	3
1907.....	0	0	2	0	0	0	0	0	0	2	0	6	10
1908.....	0	1	0	0	0	0	0	0	1	0	0	0	2
1909.....	1	2	0	0	0	0	0	0	0	1	0	0	4
1910.....	1	0	0	0	0	0	0	0	0	0	0	0	1
1911.....	1	0	0	0	0	0	0	0	0	0	0	1	2
1912.....	0	0	0	1	0	0	0	0	0	0	0	1	2
1913.....	0	0	0	0	0	0	1	0	1	0	0	0	2
1904-1913....	**4**	**4**	**7**	**1**	**0**	**0**	**2**	**0**	**2**	**4**	**1**	**8**	**33**
1887-1913....	**5**	**11**	**11**	**2**	**4**	**1**	**3**	**3**	**4**	**5**	**5**	**19**	**73**

Fort Smith, Sebastian County, Ark.

[Lat., 35° 22′ N.; long., 94° 24′ W. Elevation. 457 feet.]

Year.	Jan	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1883-1903....	18	26	63	100	122	132	124	115	58	37	35	10	840
1904.....	1	3	9	7	11	12	15	12	6	2	0	0	78
1905.....	1	0	4	5	15	9	10	9	8	5	1	0	67
1906.....	3	1	6	7	9	12	9	18	8	0	3	1	77
1907.....	0	2	4	6	12	11	6	8	4	2	0	0	55
1908.....	1	2	1	3	10	9	6	8	3	1	6	0	50
1909.....	2	3	2	8	7	12	3	2	4	3	1	1	48
1910.....	1	1	2	5	8	8	4	8	5	3	2	0	47
1911.....	1	2	1	6	4	7	5	6	3	1	2	0	38
1912.....	2	1	1	7	3	9	10	6	4	2	1	0	46
1913.....	2	1	5	5	8	9	7	5	7	3	1	0	53
1904-1913....	**14**	**16**	**35**	**59**	**87**	**98**	**75**	**82**	**52**	**22**	**17**	**2**	**559**
1883-1913....	**32**	**42**	**98**	**159**	**209**	**230**	**199**	**197**	**110**	**59**	**52**	**12**	**1,399**

Fresno, Fresno County, Cal.

[Lat., 36° 43′ N.; long., 119° 49′ W. Elevation, 330 feet.]

Year.	Jan	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1888-1903....	1	3	8	2	4	1	1	3	10	5	1	2	41
1904.....	0	0	2	1	0	0	0	0	1	2	0	0	6
1905.....	0	0	0	0	1	0	0	0	0	0	0	0	1
1906.....	0	3	0	0	0	0	0	0	0	0	0	0	3
1907.....	0	0	0	0	0	1	0	0	0	0	0	0	1
1908.....	0	1	0	0	0	0	0	0	1	0	1	0	3
1909.....	0	0	1	0	0	0	0	0	0	0	1	1	3
1910.....	0	0	0	0	1	0	1	0	0	1	0	0	3
1911.....	0	1	0	0	0	0	0	0	0	0	0	1	2
1912.....	1	0	3	2	3	0	0	0	0	0	0	0	9
1913.....	0	0	0	2	1	1	0	0	2	0	0	0	6
1904-1913....	**1**	**5**	**6**	**5**	**6**	**2**	**1**	**0**	**4**	**3**	**2**	**2**	**37**
1888-1913....	**2**	**8**	**14**	**7**	**10**	**3**	**2**	**3**	**14**	**8**	**3**	**4**	**78**

Galveston, Galveston County, Tex.

[Lat., 29° 18′ N.; long., 94° 50′ W. Elevation, 69 feet.]

Year.	Jan	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884-1903....	23	44	47	62	76	90	133	146	68	33	30	25	777
1904.....	1	1	5	6	6	6	8	10	8	1	2	1	55
1905.....	1	1	2	5	6	2	8	10	5	1	1	0	42
1906.....	2	2	0	3	1	2	13	5	6	1	0	1	36
1907.....	0	1	2	5	8	0	2	8	7	5	5	2	45
1908.....	0	6	1	5	2	5	16	8	7	0	1	1	52
1909.....	0	3	3	6	6	9	2	6	4	4	2	3	48
1910.....	1	2	1	2	6	7	5	2	6	1	1	2	36
1911.....	1	0	3	6	5	4	12	11	14	6	2	2	66
1912.....	1	2	4	1	6	7	6	11	6	0	0	5	49
1913.....	1	1	0	2	3	3	8	13	11	5	3	2	52
1904-1913....	**8**	**19**	**21**	**40**	**49**	**45**	**80**	**84**	**75**	**24**	**17**	**19**	**481**
1884-1913....	**31**	**63**	**68**	**102**	**125**	**135**	**213**	**230**	**143**	**57**	**47**	**44**	**1,258**

Grand Haven, Ottawa County, Mich.

[Lat., 3° 5′ N.; long., 86° 13′ W. Elevation, 628 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1890-1903 [a]...	2	1	7	27	63	60	46	42	33	12	2	1	296
1904.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1905.....	.....	.....	.....	.....	.....	.....	.....	*6	*4	*2	0	0	.....
1906.....	0	1	0	3	8	5	7	8	3	0	0	0	35
1907.....	1	0	5	1	2	8	8	6	3	2	0	0	36
1908.....	0	0	1	5	8	4	8	5	1	0	3	0	35
1909.....	2	0	0	5	8	8	5	7	3	1	3	0	42
1910.....	0	0	2	3	2	3	6	7	4	4	1	0	32
1911.....	0	0	0	3	10	8	7	7	9	2	2	0	48
1912.....	0	0	1	4	12	4	12	6	6	3	1	1	50
1913.....	1	0	5	2	4	8	10	10	2	3	1	0	46
1904-1913....	**4**	**1**	**14**	**26**	**54**	**48**	**63**	**56**	**31**	**15**	**11**	**1**	**324**
1890-1913....	**6**	**2**	**21**	**53**	**117**	**108**	**109**	**114**	**68**	**29**	**13**	**2**	**620**

Green Bay, Brown County, Wis.

[Lat., 44° 31′ N.; long., 80° 00′ W. Elevation, 586 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1887-1903....	1	0	10	28	74	85	98	63	48	22	4	0	433
1904.....	0	0	2	0	6	3	6	5	7	3	0	0	32
1905.....	0	0	2	3	3	11	10	10	4	1	0	0	44
1906.....	0	0	0	2	7	7	7	8	7	1	0	0	39
1907.....	0	0	2	0	3	5	8	7	3	1	0	0	29
1908.....	0	0	0	2	3	5	0	6	3	0	2	0	21
1909.....	0	0	0	2	5	6	4	6	1	1	1	0	26
1910.....	0	0	0	1	2	2	4	6	6	2	0	0	23
1911.....	0	0	1	0	8	5	7	7	7	2	1	0	38
1912.....	0	0	0	3	10	2	15	6	6	3	0	0	45
1913.....	0	0	3	2	4	8	10	6	6	2	0	0	41
1904-1913....	**0**	**0**	**10**	**15**	**51**	**54**	**71**	**67**	**50**	**16**	**4**	**0**	**338**
1887-1913....	**1**	**0**	**20**	**43**	**125**	**139**	**169**	**130**	**98**	**38**	**8**	**0**	**771**

Hannibal, Marion County, Mo.

[Lat., 39° 41′ N.; long., 91° 20′ W. Elevation, 534 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1892-1903 [b]...	6	5	22	42	94	97	92	65	57	16	11	3	510
1904.....	0	1	5	2	5	9	10	12	7	3	0	1	55
1905.....	1	0	4	4	5	5	8	12	8	5	1	0	53
1906.....	0	1	1	7	9	9	7	5	5	1	1	1	47
1907.....	2	0	6	6	6	10	11	11	4	1	0	1	58
1908.....	0	2	6	6	14	10	9	7	2	1	4	0	61
1909.....	2	2	2	7	6	10	6	2	5	3	3	1	49
1910.....	0	1	0	4	9	8	9	6	5	2	1	0	45
1911.....	1	1	4	5	6	10	7	3	12	3	2	0	54
1912.....	0	0	2	6	11	12	6	10	4	4	0	0	55
1913.....	0	0	6	1	8	11	6	9	4	1	3	0	49
1904-1913....	**6**	**8**	**36**	**48**	**79**	**94**	**79**	**77**	**56**	**24**	**15**	**4**	**526**
1892-1913....	**12**	**13**	**58**	**90**	**173**	**191**	**171**	**142**	**113**	**40**	**26**	**7**	**1,036**

Harrisburg, Dauphin County, Pa.

[Lat., 40° 16′ N.; long., 76° 52′ W. Elevation, 374 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1889-1903....	0	1	7	17	59	87	94	61	37	4	3	0	370
1904.....	0	1	0	1	8	9	12	7	3	2	0	0	43
1905.....	0	0	2	4	5	6	13	10	1	1	0	0	42
1906.....	0	0	0	3	1	12	8	9	3	1	0	0	37
1907.....	0	0	1	1	1	5	11	4	7	0	0	1	31
1908.....	1	0	3	2	6	5	12	5	1	2	0	0	37
1909.....	0	0	0	1	3	8	3	2	0	2	0	0	19
1910.....	0	0	1	4	5	4	7	2	4	1	0	0	28
1911.....	0	1	2	0	8	9	8	8	0	0	0	0	36
1912.....	0	1	1	7	3	6	12	8	4	2	0	0	44
1913.....	1	1	2	5	1	4	9	7	4	3	0	1	38
1904-1913....	**2**	**4**	**12**	**28**	**41**	**68**	**95**	**62**	**27**	**14**	**0**	**2**	**355**
1889-1913....	**2**	**5**	**19**	**45**	**100**	**155**	**189**	**123**	**64**	**18**	**3**	**2**	**725**

[a] No record from July, 1903, to July, 1905, both inclusive.

[b] First 4 months of 1892 missing.

*Not included in values on charts W.H.A.—8, 9, 10, and 13.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Hatteras, Dare County, N. C.

[Lat., 35° 15′ N.; long., 75° 40′ W. Elevation, 11 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1880-1903 [10]	6	8	26	28	59	67	74	70	26	16	11	10	401
1904	0	0	4	6	6	4	13	4	4	0	0	0	41
1905	1	1	4	6	7	4	7	1	3	0	1	0	35
1906	1	1	1	3	3	6	5	4	3	2	2	0	31
1907	0	1	2	2	5	7	7	7	8	2	2	0	43
1908	1	1	3	3	4	7	3	9	1	2	0	0	34
1909	1	2	2	5	3	7	4	9	1	1	3	0	38
1910	3	0	1	4	4	8	7	9	3	3	0	0	42
1911	0	0	3	1	1	6	5	4	9	0	0	0	29
1912	0	1	0	3	7	6	3	3	1	0	1	0	25
1913	1	1	2	1	4	4	8	7	3	2	0	2	35
1904-1913	**8**	**8**	**22**	**34**	**44**	**59**	**62**	**57**	**36**	**12**	**9**	**2**	**353**
1886-1913	14	16	48	62	103	126	136	127	62	28	20	12	754

Havre, Hill County, Mont.

[Lat., 48° 34′ N.; long., 109° 40′ W. Elevation, 2,492 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1882-1903	0	0	0	7	55	104	98	77	30	0	2	0	373
1904	0	0	0	0	2	7	4	5	1	0	0	0	19
1905	0	0	0	1	0	6	11	9	1	0	0	0	28
1906	0	0	0	0	1	6	5	5	0	0	0	0	17
1907	0	0	0	0	2	8	3	4	2	0	0	0	19
1908	0	0	0	1	3	9	5	7	5	0	0	0	30
1909	0	0	0	0	3	8	10	8	3	0	0	0	32
1910	0	0	1	3	0	11	5	3	2	0	0	0	25
1911	0	0	0	0	0	10	6	8	2	0	0	0	26
1912	0	0	0	0	1	5	5	2	1	0	0	0	14
1913	0	0	0	0	4	0	5	6	2	0	0	0	26
1904-1913	**0**	**0**	**1**	**5**	**16**	**79**	**59**	**57**	**19**	**0**	**0**	**0**	**236**
1882-1913	0	0	1	12	71	183	157	134	49	0	2	0	609

Honolulu, Island of Oahu, Hawaiian Islands.

[Lat., 21° 19′ N.; long., 157° 52′ W. Elevation, 38 feet.]

(U. S. Weather Bureau station established Sept. 1, 1904.)

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1904									(?)	(?)	(?)	(?)	
1905	0	0	0	0	0	0	0	0	0	0	1	0	1
1906	0	0	1	0	0	0	0	0	0	0	0	1	2
1907	5	1	0	0	0	0	0	0	0	0	0	1	7
1908	0	1	0	0	0	0	0	0	1	0	0	0	2
1909	0	2	0	0	0	0	0	0	0	1	0	5	8
1910	1	0	0	0	0	0	0	0	1	0	1	1	4
1911	1	2	0	1	1	0	0	0	0	0	0	0	5
1912	0	0	0	0	0	0	0	0	0	0	0	0	0
1913	1	0	0	0	0	1	0	0	1	3	1	0	7
1905-1913	**8**	**6**	**1**	**1**	**1**	**1**	**0**	**0**	**3**	**4**	**3**	**8**	**36**

Huron, Beadle County, S. Dak.

[Lat., 44° 21′ N.; long., 98° 14′ W. Elevation, 1,306 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1882-1903	0	0	5	46	92	176	178	147	77	19	2	0	742
1904	0	0	0	3	3	9	7	5	3	0	0	0	30
1905	0	0	0	0	6	16	12	8	3	1	0	0	46
1906	0	0	0	1	7	6	8	8	3	0	0	0	33
1907	0	0	0	0	3	9	12	6	6	0	0	0	36
1908	0	0	1	2	4	11	7	7	3	1	0	0	36
1909	0	0	0	0	3	7	5	6	3	1	0	0	25
1910	0	0	2	2	0	7	6	7	2	1	0	0	27
1911	0	0	1	1	5	10	9	9	6	0	0	0	41
1912	0	0	0	3	6	3	8	7	5	0	0	0	32
1913	0	0	0	3	6	4	9	10	3	2	0	0	37
1904-1913	**0**	**0**	**4**	**15**	**43**	**82**	**83**	**73**	**37**	**6**	**0**	**0**	**343**
1882-1913	0	0	9	61	135	258	261	220	114	25	2	0	1,085

[10] Record for 1889 incomplete.

Indianapolis, Marion County, Ind.

[Lat., 39° 46′ N.; long., 86° 10′ W. Elevation, 822 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1871-1903 [11]	6	25	66	84	177	206	183	163	90	45	25	12	1,082
1904	0	1	6	4	3	9	7	5	9	2	0	1	47
1905	0	0	2	4	9	7	6	9	3	1	0	0	41
1906	1	0	0	3	6	7	8	10	5	1	0	0	41
1907	0	0	6	3	4	11	9	4	4	1	0	2	44
1908	0	1	5	3	7	6	7	4	0	1	3	0	37
1909	2	1	2	4	9	9	9	8	5	1	2	0	52
1910	0	0	0	3	4	6	8	4	5	0	3	0	33
1911	2	0	1	9	5	12	9	5	11	3	2	0	59
1912	0	2	3	7	9	11	11	9	5	2	1	0	60
1913	1	0	6	2	6	11	12	7	4	1	3	0	53
1904-1913	**6**	**5**	**31**	**42**	**62**	**89**	**88**	**65**	**51**	**13**	**14**	**3**	**467**
1871-1913	12	30	97	126	239	295	269	228	141	58	39	15	1,549

Jacksonville, Duval County, Fla.

[Lat., 30° 20′ N.; long., 81° 39′ W. Elevation, 43 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1872-1903	18	33	73	86	181	324	367	360	130	29	24	21	1,646
1904	3	0	2	4	6	14	20	15	8	3	1	0	76
1905	1	1	5	7	18	12	21	15	7	0	0	1	88
1906	1	0	1	2	4	17	18	14	6	3	0	0	66
1907	0	1	2	4	12	9	23	22	17	1	0	3	94
1908	0	1	2	9	10	13	18	12	6	2	0	0	73
1909	1	4	5	3	9	12	20	15	7	1	1	0	78
1910	1	4	3	3	8	14	22	16	9	2	0	0	82
1911	0	0	2	1	0	16	17	18	6	4	1	1	66
1912	1	4	4	7	12	13	14	17	13	3	0	0	88
1913	2	3	5	2	7	11	24	19	8	1	0	2	84
1904-1913	**10**	**18**	**31**	**42**	**86**	**131**	**197**	**163**	**87**	**20**	**3**	**7**	**795**
1872-1913	28	51	104	128	267	455	564	523	217	49	27	28	2,441

Kansas City, Jackson County, Mo.

[Lat., 39° 5′ N.; long., 94° 37′ W. Elevation, 909 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1889-1903	5	11	34	83	133	140	133	137	74	30	16	8	804
1904	0	1	6	5	7	12	13	8	4	1	0	0	57
1905	0	0	7	4	9	8	10	5	8	3	2	0	56
1906	1	2	2	5	9	8	9	12	9	0	1	0	58
1907	2	0	6	3	5	12	10	10	6	3	0	2	59
1908	0	1	2	6	11	14	10	7	0	4	5	0	60
1909	1	1	2	7	6	11	14	3	11	3	2	1	62
1910	0	1	0	7	9	10	8	6	11	0	0	0	52
1911	1	4	3	7	7	9	9	8	10	4	4	0	66
1912	0	1	1	4	9	10	15	8	5	5	1	0	59
1913	0	0	4	4	9	8	6	4	5	4	2	0	46
1904-1913	**5**	**11**	**33**	**52**	**81**	**102**	**104**	**71**	**69**	**27**	**17**	**3**	**575**
1889-1913	10	22	67	135	214	242	237	208	143	57	33	11	1,379

Keokuk, Lee County, Iowa.

[Lat., 40° 22′ N.; long., 91° 26′ W. Elevation, 614 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884-1903	4	4	40	80	129	144	135	115	92	39	14	6	802
1904	0	2	4	3	6	9	7	11	6	3	0	1	52
1905	0	0	4	6	7	7	7	10	5	5	1	0	52
1906	1	1	2	1	8	8	12	12	4	2	0	0	51
1907	2	0	4	1	4	11	13	8	5	2	0	1	51
1908	0	1	4	4	13	10	12	5	3	2	3	0	57
1909	2	2	2	6	9	10	5	4	5	4	4	1	54
1910	0	0	2	4	10	7	10	3	7	1	0	0	44
1911	1	2	2	7	6	9	6	8	11	3	2	0	57
1912	0	0	1	4	9	8	9	8	6	5	2	0	52
1913	0	0	4	3	12	8	5	9	2	2	1	0	46
1904-1913	**6**	**8**	**29**	**39**	**84**	**87**	**86**	**78**	**54**	**29**	**13**	**3**	**516**
1884-1913	10	12	69	119	213	231	221	193	146	68	27	9	1,318

[11] Record for January and February, 1871, missing.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Key West, Monroe County, Fla.

[Lat., 24° 33′ N.; long., 81° 48′ W. Elevation, 14 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884–1903....	14	21	26	29	54	87	138	197	134	44	20	17	781
1904.....	0	1	1	2	2	11	7	7	4	2	1	1	39
1905.....	0	0	2	4	4	4	9	11	14	3	0	6	57
1906.....	2	3	2	1	6	5	13	18	9	3	2	0	64
1907.....	0	0	0	1	6	14	12	13	14	3	2	2	67
1908.....	1	2	1	1	3	13	9	12	14	4	1	0	61
1909.....	0	1	0	3	8	15	7	15	9	1	0	1	60
1910.....	1	2	1	0	3	9	11	9	5	1	0	0	42
1911.....	0	0	2	3	3	3	13	10	8	2	1	0	45
1912.....	1	1	4	0	4	11	6	13	6	7	0	1	54
1913.....	0	1	0	4	3	7	14	12	7	2	0	0	50
1904–1913....	**5**	**11**	**13**	**19**	**42**	**92**	**101**	**120**	**90**	**28**	**7**	**11**	**539**
1884–1913....	19	32	39	48	96	179	239	317	224	72	27	28	1,320

Knoxville, Knox County, Tenn.

[Lat., 35° 56′ N.; long., 83° 58′ W. Elevation, 1,007 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1882–1903....	7	18	55	56	108	181	171	143	47	13	9	4	812
1904.....	0	3	5	1	2	8	10	13	3	0	0	1	46
1905.....	0	0	3	8	6	12	14	12	2	0	1	0	58
1906.....	0	0	0	5	8	11	14	18	8	0	3	0	67
1907.....	0	1	4	4	4	10	9	12	5	1	2	1	53
1908.....	1	0	5	2	8	6	14	9	2	1	3	0	51
1909.....	1	3	7	7	13	14	10	6	4	2	1	1	69
1910.....	0	2	3	5	9	10	16	10	13	0	2	1	71
1911.....	0	2	4	7	6	10	10	10	9	2	0	0	60
1912.....	0	2	0	8	10	12	12	9	4	1	1	1	60
1913.....	0	2	3	1	8	11	13	6	1	1	0	0	46
1904–1913....	**2**	**15**	**34**	**48**	**74**	**104**	**122**	**105**	**51**	**8**	**13**	**5**	**551**
1882–1913....	9	33	89	104	182	285	293	248	98	21	22	9	1,393

La Crosse, La Crosse County, Wis.

[Lat., 43° 49′ N.; long., 91° 15′ W. Elevation, 681 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1875–1903....	1	3	24	60	103	166	141	118	79	38	7	0	740
1904.....	0	0	2	2	4	7	6	4	10	1	0	0	36
1905.....	0	0	0	2	6	13	5	9	4	1	0	0	40
1906.....	0	0	1	3	8	7	6	7	8	0	0	0	40
1907.....	0	0	2	0	7	6	7	7	8	0	0	0	37
1908.....	0	0	1	2	10	8	8	5	3	1	1	0	39
1909.....	1	0	0	7	5	7	3	11	4	2	2	0	42
1910.....	0	0	0	1	2	2	6	15	4	0	0	0	30
1911.....	0	0	0	0	10	10	10	9	12	5	2	0	58
1912.....	0	0	0	7	12	4	12	10	5	1	0	1	52
1913.....	0	0	2	1	10	6	14	6	5	5	1	0	50
1904–1913....	**1**	**0**	**8**	**25**	**74**	**70**	**77**	**83**	**63**	**16**	**6**	**1**	**424**
1875–1913....	2	3	32	85	177	236	218	201	142	54	13	1	1,164

Lander, Fremont County, Wyo.

[Lat., 42° 50′ N.; long., 108° 45′ W. Elevation, 5,408 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1892–1903....	0	0	0	3	24	45	42	47	13	3	0	0	177
1904.....	0	0	0	1	2	6	8	5	1	0	0	0	23
1905.....	0	0	0	0	5	3	9	9	0	0	0	0	26
1906.....	0	0	0	1	3	3	6	7	3	0	0	0	23
1907.....	0	0	0	0	1	6	2	4	3	0	0	0	16
1908.....	0	0	0	2	0	7	2	5	4	0	0	0	20
1909.....	0	0	0	0	4	6	2	5	3	1	0	0	21
1910.....	0	0	0	0	3	7	12	5	1	0	0	0	28
1911.....	0	0	0	1	3	9	7	7	5	0	0	0	32
1912.....	0	0	0	2	2	8	10	7	4	0	0	0	33
1913.....	0	0	0	1	9	9	6	2	2	0	0	0	29
1904–1913....	**0**	**0**	**0**	**8**	**32**	**64**	**64**	**56**	**26**	**1**	**0**	**0**	**251**
1892–1913....	0	0	0	11	56	109	106	103	39	4	0	0	428

Lexington, Fayette County, Ky.

[Lat., 38° 2′ N.; long., 84° 33′ W. Elevation, 978 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1888–1903....	2	17	30	33	78	99	112	89	39	18	9	7	533
1904.....	0	1	6	3	5	11	12	6	7	0	0	0	51
1905.....	0	0	0	6	10	7	9	8	2	1	2	0	45
1906.....	1	1	1	4	5	9	8	14	10	0	0	0	53
1907.....	3	0	3	4	4	15	10	9	6	0	3	0	57
1908.....	0	2	5	5	9	6	13	9	3	0	2	0	54
1909.....	1	4	4	7	9	15	12	8	5	1	3	0	69
1910.....	0	0	3	3	6	10	21	6	12	1	1	0	63
1911.....	0	2	3	7	6	11	10	11	11	3	1	1	66
1912.....	0	4	1	10	11	12	15	10	3	0	0	0	66
1913.....	1	0	5	4	8	12	16	12	3	1	1	0	63
1904–1913....	**6**	**14**	**31**	**53**	**73**	**108**	**126**	**93**	**62**	**7**	**13**	**1**	**587**
1888–1913....	8	31	61	86	151	207	238	182	101	25	22	8	1,120

Little Rock, Pulaski County, Ark.

[Lat., 34° 45′ N.; long., 92° 6′ W. Elevation, 287 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1880–1903....	27	33	76	99	129	154	163	120	53	26	30	27	937
1904.....	1	4	8	7	5	13	13	8	2	3	0	0	64
1905.....	1	0	2	11	11	8	11	11	6	2	2	1	66
1906.....	2	2	2	4	7	11	11	12	9	0	3	3	66
1907.....	2	4	4	7	8	9	3	8	3	2	0	0	50
1908.....	1	4	5	7	6	6	12	11	5	0	6	0	63
1909.....	3	6	6	8	7	9	8	2	6	2	3	3	63
1910.....	0	2	3	6	7	14	13	10	6	3	0	1	65
1911.....	0	2	1	10	2	10	5	7	9	1	1	0	48
1912.....	1	4	5	10	4	11	8	10	5	1	0	0	59
1913.....	3	2	5	4	4	7	13	5	8	5	1	0	57
1904–1913....	**14**	**30**	**41**	**74**	**61**	**93**	**87**	**84**	**59**	**19**	**16**	**8**	**601**
1880–1913....	41	63	117	173	190	252	260	204	112	45	46	35	1,538

Los Angeles, Los Angeles County, Cal.

[Lat., 34° 03′ N.; long., 118° 15′ W. Elevation, 338 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1877–1903....	5	2	7	5	5	3	2	3	3	1	1	2	39
1904.....	0	0	0	0	0	0	0	3	0	0	0	0	3
1905.....	0	3	2	3	0	0	0	0	0	0	0	0	8
1906.....	0	0	1	2	0	0	1	0	1	0	0	0	5
1907.....	0	0	2	0	1	1	0	0	0	2	1	0	7
1908.....	1	1	0	0	0	0	0	1	3	1	0	0	7
1909.....	1	0	2	0	0	0	0	0	0	0	0	0	3
1910.....	1	0	0	0	0	0	0	1	1	1	0	0	4
1911.....	1	0	0	0	0	0	0	0	0	0	0	0	1
1912.....	0	0	2	0	0	0	0	0	0	0	0	0	2
1913.....	2	1	0	1	0	0	0	0	0	0	0	0	4
1904–1913....	**6**	**6**	**9**	**6**	**1**	**1**	**1**	**5**	**5**	**4**	**1**	**0**	**44**
1877–1913....	11	8	16	11	6	4	3	8	8	5	2	2	83

Louisville, Jefferson County, Ky.

[Lat., 38° 15′ N.; long., 85° 45′ W. Elevation, 525 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1890–1903....	4	13	36	40	80	102	84	86	35	14	6	3	503
1904.....	0	1	6	3	3	9	8	3	7	1	0	0	41
1905.....	0	0	3	8	12	8	9	6	3	2	2	0	53
1906.....	1	1	2	5	6	7	11	12	6	0	3	1	55
1907.....	4	0	2	5	5	11	9	5	5	1	1	0	48
1908.....	1	2	7	5	7	7	9	6	2	0	4	0	50
1909.....	0	7	5	5	7	14	10	5	2	3	1	0	59
1910.....	0	0	1	2	4	10	18	3	10	2	3	0	53
1911.....	2	2	4	10	7	8	7	2	8	2	1	0	53
1912.....	0	1	2	7	7	8	18	12	7	1	1	0	64
1913.....	2	0	5	4	7	13	7	12	3	1	2	0	56
1904–1913....	**10**	**14**	**37**	**54**	**65**	**95**	**106**	**66**	**53**	**13**	**18**	**1**	**532**
1890–1913....	14	27	73	94	145	197	190	152	88	27	24	4	1,035

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Lynchburg, Campbell County, Va.

[Lat., 37° 25′ N.; long., 79° 9′ W. Elevation, 681 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884–1903....	0	10	12	28	99	116	137	100	33	5	7	0	556
1904.....	0	0	1	1	3	10	9	6	3	0	0	0	33
1905.....	0	0	0	3	7	7	12	6	2	0	0	0	37
1906.....	0	0	1	4	2	10	7	11	4	0	0	4	39
1907.....	0	0	2	3	3	7	9	3	5	0	0	0	32
1908.....	0	0	1	3	5	7	7	6	0	0	0	0	29
1909.....	0	1	0	3	3	17	2	3	1	2	0	0	32
1910.....	0	1	0	4	6	6	12	3	4	0	0	0	36
1911.....	0	0	1	1	5	9	7	10	1	2	0	0	36
1912.....	0	1	2	4	3	8	9	4	4	0	0	0	35
1913.....	0	0	1	1	5	9	8	9	1	0	0	0	34
1904–1913....	**0**	**3**	**9**	**27**	**42**	**90**	**82**	**61**	**25**	**4**	**0**	**0**	**343**
1884–1913....	0	13	21	55	141	206	219	170	58	9	7	0	899

Marquette, Marquette County, Mich.

[Lat., 46° 34′ N.; long., 87° 24′ W. Elevation, 734 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1876–1903 [12]..	0	0	6	27	47	90	99	82	54	16	3	0	424
1904.....	0	0	0	1	5	6	4	5	2	0	0	0	23
1905.....	0	0	2	1	3	6	5	6	2	1	0	0	26
1906.....	0	0	0	0	6	7	6	6	3	0	0	0	28
1907.....	0	0	3	0	3	8	7	5	1	0	0	0	27
1908.....	0	0	1	1	2	6	4	3	3	1	0	0	21
1909.....	0	0	0	0	2	5	7	5	1	0	1	0	21
1910.....	0	0	3	1	1	2	4	4	3	1	0	0	19
1911.....	0	0	0	0	6	7	9	3	2	0	1	0	28
1912.....	0	0	0	0	4	2	7	2	5	0	0	0	20
1913.....	0	0	1	2	1	8	8	4	2	3	0	0	29
1904–1913....	**0**	**0**	**10**	**6**	**33**	**57**	**61**	**43**	**24**	**6**	**2**	**0**	**242**
1876–1913....	0	0	16	33	80	147	160	125	78	22	5	0	666

Memphis, Shelby County, Tenn.

[Lat., 35° 9′ N.; long., 90° 3′ W. Elevation, 399 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1882–1903....	23	35	75	85	117	134	157	117	51	22	25	19	860
1904.....	1	1	6	4	6	11	15	5	1	1	0	2	53
1905.....	1	0	2	8	9	12	7	8	4	2	2	0	56
1906.....	2	2	2	6	9	4	9	7	5	0	3	1	50
1907.....	5	2	5	5	5	4	8	5	4	1	1	2	47
1908.....	2	2	4	7	7	8	12	8	3	1	5	1	60
1909.....	3	5	6	7	6	13	5	5	4	2	4	0	60
1910.....	1	2	4	6	3	12	11	5	6	4	1	2	57
1911.....	0	1	0	5	6	9	8	8	1	0	0	0	38
1912.....	0	3	2	6	6	9	8	9	6	1	0	0	50
1913.....	2	2	3	1	2	8	9	5	6	1	0	0	39
1904–1913....	**17**	**20**	**34**	**55**	**59**	**90**	**92**	**65**	**40**	**13**	**16**	**8**	**509**
1882–1913....	40	55	109	140	176	224	249	182	91	35	41	27	1,369

Milwaukee, Milwaukee County, Wis.

[Lat., 43° 2′ N.; long., 87° 54′ W. Elevation, 681 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1871–1903 [13]..	3	6	26	66	134	168	167	125	77	48	17	2	839
1904.....	0	0	4	2	8	8	7	7	11	3	0	0	50
1905.....	0	0	3	3	7	10	7	10	2	1	0	0	43
1906.....	2	0	0	3	4	5	4	9	4	0	0	0	31
1907.....	1	0	3	4	3	9	8	5	4	3	0	0	40
1908.....	0	0	2	5	6	8	5	4	0	1	1	0	32
1909.....	2	0	0	7	4	5	3	5	3	0	0	0	29
1910.....	0	0	2	3	2	2	4	8	3	0	1	0	25
1911.....	0	0	0	2	6	5	4	9	9	1	1	0	37
1912.....	0	0	1	4	11	4	8	6	5	3	1	0	43
1913.....	0	0	2	2	6	8	11	9	3	2	1	0	44
1904–1913....	**5**	**0**	**17**	**35**	**57**	**64**	**61**	**72**	**44**	**14**	**5**	**0**	**374**
1871–1913....	8	6	43	101	191	232	228	197	121	62	22	2	1,213

Minneapolis, Hennepin County, Minn.

[Lat., 44° 59′ N.; long., 93° 18′ W. Elevation, 918 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1893–1903....	0	0	7	32	59	68	68	77	45	34	3	0	393
1904.....	0	0	0	0	5	9	4	5	3	2	0	0	28
1905.....	0	0	0	1	6	12	6	10	4	1	0	0	40
1906.....	0	0	0	3	9	5	8	7	7	0	0	0	39
1907.....	0	0	1	0	3	8	6	6	6	2	0	0	32
1908.....	0	0	1	2	8	9	6	4	6	1	1	0	38
1909.....	1	0	0	2	5	10	2	12	7	2	0	0	41
1910.....	0	0	0	2	1	4	3	9	2	2	0	0	23
1911.....	0	0	0	1	7	11	12	11	8	3	0	0	53
1912.....	0	0	0	3	8	2	8	13	4	0	0	0	38
1913.....	0	0	2	2	4	5	12	3	3	2	1	0	34
1904–1913....	**1**	**0**	**4**	**16**	**56**	**75**	**67**	**80**	**50**	**15**	**2**	**0**	**366**
1893–1913....	1	0	11	48	115	143	135	157	95	49	5	0	759

Mobile, Mobile County, Ala.

[Lat., 30° 41′ N.; long., 88° 02′ W. Elevation, 57 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1881–1903....	27	47	66	76	118	193	255	222	76	29	20	34	1,163
1904.....	2	3	5	1	3	9	18	9	4	1	1	0	56
1905.....	1	1	4	4	8	11	16	20	10	1	1	1	78
1906.....	2	3	6	1	6	14	19	16	16	2	1	1	87
1907.....	0	3	3	5	9	14	18	21	8	1	1	4	87
1908.....	2	1	3	10	7	16	16	9	9	1	1	0	75
1909.....	0	5	3	7	10	13	12	11	14	1	2	1	79
1910.....	1	5	3	2	6	14	14	12	12	3	1	0	73
1911.....	0	2	2	4	8	14	15	14	9	4	1	0	73
1912.....	1	4	5	10	4	7	19	14	6	3	1	1	75
1913.....	3	5	7	3	6	12	19	9	8	1	0	1	74
1904–1913....	**12**	**32**	**41**	**47**	**67**	**124**	**168**	**135**	**96**	**18**	**10**	**9**	**757**
1881–1913....	39	79	107	123	185	317	421	357	172	47	30	43	1,920

Montgomery, Montgomery County, Ala.

[Lat., 32° 23′ N.; long., 86° 18′ W. Elevation, 223 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884–1903 [14]..	16	42	60	60	115	194	216	188	52	18	18	18	1,006
1904.....	2	3	4	2	3	6	8	17	2	0	1	1	49
1905.....	1	0	2	5	10	10	11	8	2	2	0	0	51
1906.....	3	3	5	0	6	11	11	10	12	1	2	0	64
1907.....	0	1	2	5	11	10	11	8	4	2	3	1	58
1908.....	2	1	2	8	8	12	13	8	3	2	2	0	61
1909.....	2	6	8	5	12	17	7	11	8	0	3	3	82
1910.....	3	4	3	4	5	12	16	8	8	2	2	1	68
1911.....	0	1	1	5	4	14	11	7	11	2	1	0	57
1912.....	0	3	3	9	6	10	10	14	8	0	0	1	64
1913.....	3	5	8	1	8	13	16	10	6	0	0	0	70
1904–1913....	**16**	**27**	**38**	**44**	**73**	**115**	**114**	**101**	**64**	**11**	**14**	**7**	**624**
1884–1913....	32	69	98	113	188	309	330	289	116	29	32	25	1,633

Nantucket, Nantucket County, Mass.

[Lat., 41° 17′ N.; long., 70° 06′ W. Elevation, 121 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1887–1903....	1	9	7	11	20	32	44	38	17	6	2	5	192
1904.....	0	0	0	5	2	3	5	3	1	0	2	0	21
1905.....	0	0	0	1	3	3	4	4	0	0	0	0	15
1906.....	0	0	0	1	2	5	4	4	5	1	1	0	23
1907.....	2	0	1	3	3	3	7	1	2	0	0	0	22
1908.....	2	1	2	2	0	1	7	3	0	1	2	0	21
1909.....	0	0	0	3	3	5	4	0	0	2	2	1	20
1910.....	1	3	2	2	5	4	5	3	1	3	1	0	30
1911.....	0	1	3	0	3	5	3	3	3	0	2	0	23
1912.....	0	0	2	2	4	2	7	4	4	1	2	0	28
1913.....	0	2	1	1	2	1	1	5	3	4	0	0	20
1904–1913....	**5**	**7**	**11**	**20**	**27**	**32**	**47**	**30**	**19**	**12**	**12**	**1**	**223**
1887–1913....	6	16	18	31	47	64	91	68	36	18	14	6	415

[12] Record for 1878, 1879, 1880, 1881, and 1883 missing.

[13] Record for 1871 and 1872 apparently incomplete.

[14] Record for 1884 and 1885 incomplete.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Narragansett Pier, Washington County, R. I.

[Lat., 41° 19′ N.; long., 71° 17′ W. Elevation, 33 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1892–1903....	0	3	3	11	24	26	36	33	17	4	1	1	159
1904.....	0	0	0	1	2	3	5	2	1	0	0	0	14
1905.....	0	0	0	2	2	3	7	5	1	0	1	0	21
1906.....	0	0	0	2	1	3	3	2	2	0	1	0	14
1907.....	1	0	1	4	4	1	2	0	5	0	0	0	18
1908.....	0	0	2	0	0	4	5	3	0	0	0	0	14
1909.....	0	0	0	0	3	3	3	4	1	0	0	0	14
1910.....	0	1	2	0	2	3	3	4	1	2	0	0	18
1911.....	0	1	1	0	2	5	3	3	1	0	1	0	17
1912.....	0	1	1	1	3	1	4	4	2	1	1	0	19
1913.....	1	2	0	3	1	1	3	6	2	1	0	0	20
1904–1913....	**2**	**5**	**7**	**13**	**20**	**27**	**38**	**33**	**16**	**4**	**4**	**0**	**169**
1892–1913....	2	8	10	24	44	53	74	66	33	8	5	1	328

Nashville, Davidson County, Tenn.

[Lat., 36° 10′ N.; long., 86° 47′ W. Elevation, 546 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1871–1903 [15]..	24	54	100	138	187	271	259	167	78	29	28	16	1,351
1904.....	1	2	8	5	6	12	11	7	5	0	0	0	57
1905.....	0	0	3	6	8	8	8	5	5	1	2	1	47
1906.....	0	2	2	9	6	10	7	15	8	1	2	0	62
1907.....	1	1	4	5	7	7	9	10	3	3	1	1	52
1908.....	0	2	2	4	8	7	12	8	3	0	3	0	49
1909.....	1	5	5	6	5	15	8	6	3	3	2	1	60
1910.....	0	1	7	6	10	13	18	7	8	2	2	1	75
1911.....	2	2	4	6	4	10	10	9	10	0	0	1	58
1912.....	0	2	1	11	4	8	16	8	6	1	0	1	58
1913.....	2	2	6	1	8	12	7	7	1	0	2	0	48
1904–1913....	**7**	**19**	**42**	**59**	**66**	**102**	**106**	**82**	**52**	**11**	**14**	**6**	**566**
1871–1913....	31	73	142	197	253	373	365	249	130	40	42	22	1,917

New Haven, New Haven County, Conn.

[Lat. 41° 18′ N.; long. 72° 56′ W. Elevation, 106 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1873–1903....	1	9	20	34	71	113	149	111	46	17	5	2	578
1904.....	0	0	0	1	3	6	4	6	3	0	0	0	23
1905.....	0	0	0	3	2	6	9	5	1	0	0	1	27
1906.....	0	0	0	2	3	8	11	5	4	1	1	0	35
1907.....	1	0	2	1	4	6	4	1	6	0	0	0	25
1908.....	0	1	2	1	2	4	7	6	1	1	0	0	25
1909.....	0	0	0	1	6	3	4	2	1	2	1	0	20
1910.....	0	0	2	2	5	2	4	4	2	0	0	0	21
1911.....	0	1	1	0	4	7	5	3	2	0	0	0	23
1912.....	0	1	2	2	5	4	10	4	3	1	1	0	33
1913.....	1	1	4	0	1	3	6	9	2	2	0	0	29
1904–1913....	**2**	**4**	**13**	**13**	**35**	**49**	**64**	**45**	**25**	**7**	**3**	**1**	**261**
1873–1913....	3	13	33	47	106	162	213	156	71	24	8	3	839

New Orleans, Orleans Parish, La.

[Lat. 29° 58′ N.; long. 90° 00′ W. Elevation, 51 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1871–1903....	37	49	75	80	138	195	261	230	100	26	21	37	1,249
1904.....	1	2	5	3	4	11	19	10	9	1	0	2	67
1905.....	2	1	4	4	6	9	7	17	12	0	1	4	67
1906.....	3	1	5	3	3	12	13	15	12	1	1	0	69
1907.....	1	3	3	5	11	12	10	16	5	2	2	5	75
1908.....	2	4	2	5	4	10	17	11	11	0	0	0	66
1909.....	2	5	3	8	9	11	14	8	10	3	1	3	77
1910.....	3	3	1	3	8	12	16	9	12	6	1	0	74
1911.....	0	1	1	7	5	17	15	15	12	3	1	4	81
1912.....	2	5	6	9	11	7	19	15	12	0	2	1	89
1913.....	3	3	7	5	10	8	15	15	9	2	0	2	79
1904–1913....	**19**	**28**	**37**	**52**	**71**	**109**	**145**	**131**	**104**	**18**	**9**	**21**	**744**
1871–1913....	56	77	112	132	209	304	406	361	204	44	30	58	1,993

[15] Record for 1871 and 1872 incomplete.

New York, New York County, N. Y.

[Lat., 40° 43′ N.; long., 74° 00′ W. Elevation, 314 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1881–1903....	3	5	13	29	65	117	147	108	47	13	8	2	557
1904.....	0	0	0	1	3	7	9	9	1	0	0	0	30
1905.....	0	0	0	5	4	7	9	9	2	0	0	0	36
1906.....	1	0	0	2	6	8	10	5	4	1	0	0	37
1907.....	0	0	1	2	6	2	7	2	7	3	0	0	30
1908.....	0	0	2	1	3	4	9	4	2	0	0	0	25
1909.....	0	0	1	4	4	4	3	2	0	1	0	0	19
1910.....	0	0	0	2	4	4	1	3	1	0	0	0	15
1911.....	0	1	2	0	4	9	9	3	1	0	0	0	29
1912.....	0	1	2	5	4	3	7	8	3	1	1	0	35
1913.....	1	1	1	2	1	2	6	9	3	2	0	0	28
1904–1913....	**2**	**3**	**9**	**24**	**39**	**50**	**70**	**54**	**24**	**8**	**1**	**0**	**284**
1881–1914....	5	8	22	53	104	167	217	162	71	21	9	2	841

Norfolk, Norfolk County, Va.

[Lat., 36° 51′ N.; long., 76° 17′ W. Elevation, 91 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1885–1903....	2	6	23	36	98	99	121	107	25	11	6	3	537
1904.....	1	2	0	3	7	11	10	11	4	0	0	0	49
1905.....	0	0	3	2	7	5	13	10	4	1	0	0	45
1906.....	0	1	0	6	5	6	9	10	2	0	0	0	39
1907.....	0	1	2	3	6	8	9	8	5	0	1	1	44
1908.....	0	0	2	4	9	3	9	5	1	0	1	0	34
1909.....	0	1	1	4	3	16	5	5	0	1	2	0	38
1910.....	0	1	1	4	5	10	7	6	3	0	0	0	37
1911.....	0	1	4	2	2	10	8	8	1	2	1	0	39
1912.....	0	1	0	2	9	5	7	9	3	1	0	0	37
1913.....	1	0	2	0	6	9	14	6	4	1	0	1	44
1904–1913....	**2**	**8**	**15**	**30**	**59**	**83**	**91**	**78**	**27**	**6**	**5**	**2**	**406**
1885–1913....	4	14	38	66	157	182	212	185	52	17	11	5	943

Northfield, Washington County, Vt.

[Lat., 44° 10′ N.; long., 72° 41′ W. Elevation, 876 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1887–1903 [16]..	0	1	1	9	29	73	89	61	35	9	0	0	307
1904.....	0	0	1	0	3	3	6	6	4	0	0	0	23
1905.....	0	0	0	0	3	4	12	7	0	0	0	1	27
1906.....	0	0	0	0	7	9	7	6	3	2	0	0	34
1907.....	0	0	0	0	1	5	7	4	4	0	0	0	21
1908.....	0	0	1	2	2	5	5	4	0	1	0	0	20
1909.....	1	0	0	1	1	3	3	2	2	0	0	0	13
1910.....	0	0	0	2	3	5	7	4	2	1	0	0	24
1911.....	0	0	0	0	5	4	9	6	3	0	0	0	27
1912.....	0	0	0	1	5	4	8	6	4	2	0	0	30
1913.....	0	0	2	0	2	2	10	4	2	1	0	0	23
1904–1913....	**1**	**0**	**4**	**6**	**32**	**44**	**74**	**49**	**24**	**7**	**0**	**1**	**242**
1887–1913....	1	1	5	15	61	117	163	110	59	16	0	1	549

North Platte, Lincoln County, Nebr.

[Lat., 41° 08′ N.; long., 100° 45′ W. Elevation, 2,821 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1875–1903....	0	0	8	51	113	184	174	132	48	12	1	0	723
1904.....	0	0	1	1	8	10	11	5	1	1	0	0	38
1905.....	0	0	2	1	12	14	12	12	5	2	0	0	60
1906.....	0	0	1	6	8	7	7	8	8	1	0	0	46
1907.....	0	0	0	0	10	11	19	10	3	0	0	0	53
1908.....	0	0	0	3	6	14	10	12	2	1	0	0	48
1909.....	0	0	3	1	6	14	9	12	4	0	0	0	49
1910.....	0	0	0	2	4	8	8	8	1	0	0	0	31
1911.....	0	0	0	3	2	11	11	10	4	2	0	0	43
1912.....	0	0	0	3	6	4	14	5	4	1	1	0	38
1913.....	0	0	0	4	8	9	11	6	3	1	1	0	43
1904–1913....	**0**	**0**	**7**	**24**	**70**	**102**	**112**	**88**	**35**	**9**	**2**	**0**	**449**
1875–1913....	0	0	15	75	183	286	286	220	83	21	3	0	1,172

[16] Record for January and February, 1887, missing.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Year.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Oklahoma, Oklahoma County, Okla.													
[Lat., 35° 26′ N.; long., 97° 30′ W. Elevation, 1,214 feet.]													
1891-1903....	6	10	24	44	89	67	43	50	35	16	15	8	407
1904.....	2	0	3	6	10	9	5	4	4	2	0	0	45
1905.....	0	0	3	4	11	5	9	7	2	3	1	0	45
1906.....	0	2	5	8	9	9	12	13	9	0	0	0	67
1907.....	0	1	1	3	5	10	3	4	5	2	0	0	34
1908.....	0	3	1	9	10	13	6	9	4	5	1	0	61
1909.....	0	1	2	7	6	12	5	6	4	2	4	0	49
1910.....	0	0	1	3	7	5	3	4	4	2	0	0	29
1911.....	0	1	0	5	5	7	10	2	2	2	0	0	34
1912.....	0	1	3	6	7	8	4	5	3	3	2	0	42
1913.....	0	2	4	2	7	9	4	3	7	2	1	1	42
1904-1913....	**2**	**11**	**23**	**53**	**77**	**87**	**61**	**57**	**44**	**23**	**9**	**1**	**448**
1891-1913....	8	21	47	97	166	154	104	107	79	39	24	9	885
Omaha, Douglas County, Nebr.													
[Lat., 41° 16′ N.; long., 95° 56′ W. Elevation, 1,105 feet.]													
1873-1903...	0	4	38	83	161	203	175	139	92	45	7	4	951
1904.....	0	0	1	6	8	8	10	9	7	4	0	0	53
1905.....	0	0	1	1	7	13	8	10	5	5	1	0	51
1906.....	0	0	1	8	8	12	9	6	7	4	1	1	58
1907.....	0	1	0	3	5	9	16	9	6	2	0	0	51
1908.....	0	0	2	4	14	14	8	10	0	1	1	0	54
1909.....	1	2	2	7	4	16	7	6	9	1	3	0	58
1910.....	0	0	0	1	2	8	7	10	4	1	0	0	33
1911.....	0	0	1	3	10	4	5	12	7	1	0	0	43
1912.....	0	0	1	2	7	5	11	10	10	5	0	0	51
1913.....	0	0	3	2	11	9	9	4	5	3	1	0	47
1904-1913....	**1**	**3**	**12**	**37**	**77**	**98**	**90**	**86**	**60**	**27**	**7**	**1**	**499**
1873-1913....	1	7	50	120	238	301	265	225	152	72	14	5	1,450
Oswego, Oswego County, N. Y.													
[Lat., 43° 29′ N.; long., 76° 35′ W. Elevation, 335 feet.]													
1871-1903....	2	3	8	23	51	101	116	80	50	25	5	3	476
1904.....	0	1	1	1	3	9	9	6	5	1	0	0	36
1905.....	0	0	0	1	4	8	7	8	4	3	1	0	36
1906.....	0	0	0	1	5	10	6	3	2	3	0	0	30
1907.....	0	0	2	1	1	3	7	4	4	2	0	0	24
1908.....	0	0	3	1	6	6	5	6	3	1	0	0	31
1909.....	1	0	0	1	5	2	6	3	2	2	0	0	22
1910.....	0	0	3	1	3	5	6	7	3	0	0	0	28
1911.....	0	1	1	0	7	8	6	6	2	2	0	0	33
1912.....	0	2	0	2	6	2	6	7	6	0	1	0	32
1913.....	1	0	3	2	2	3	7	3	1	2	0	0	24
1904-1913....	**2**	**4**	**13**	**11**	**42**	**56**	**65**	**53**	**32**	**16**	**2**	**0**	**256**
1871-1913....	4	7	21	34	93	157	181	142	82	41	7	3	772
Palestine, Anderson County, Tex.													
[Lat., 31° 45′ N.; long., 95° 40′ W. Elevation, 518 feet.]													
1882-1903....	23	32	64	74	102	102	112	86	61	46	31	29	762
1904.....	3	1	6	8	4	10	9	6	7	0	0	0	54
1905.....	2	0	3	7	8	4	8	3	2	6	0	0	43
1906.....	2	1	2	3	13	8	7	10	7	0	0	3	56
1907.....	2	4	2	8	9	9	8	4	7	5	2	2	62
1908.....	1	3	1	11	8	6	15	8	6	1	4	2	66
1909.....	1	4	4	6	8	11	6	7	3	3	0	2	55
1910.....	1	3	3	0	9	5	7	2	5	3	0	2	40
1911.....	0	3	2	10	5	4	12	5	4	3	0	0	48
1912.....	0	0	10	10	8	7	2	8	1	1	0	1	48
1913.....	0	3	4	3	3	8	3	3	9	3	2	1	42
1904-1913....	**12**	**22**	**37**	**75**	**75**	**72**	**77**	**56**	**51**	**25**	**8**	**13**	**523**
1882-1913....	35	54	101	149	177	174	189	142	112	71	39	42	1,285

Year.	Jan.	Feb.	Mar	Apr.	May.	June.	July.	Aug	Sept.	Oct.	Nov.	Dec.	Year.
Pensacola, Escambia County, Fla.													
[Lat., 30° 25′ N.; long., 87° 13′ W. Elevation, 56 feet.]													
1894-1903....	5	21	31	20	40	64	92	101	28	7	9	13	431
1904.....	3	2	4	2	4	10	19	19	7	2	1	2	75
1905.....	3	0	3	5	11	7	12	21	11	3	0	1	77
1906.....	3	2	7	1	5	14	20	16	17	3	1	0	89
1907.....	0	3	2	9	11	14	21	23	15	3	2	6	109
1908.....	2	2	3	8	7	16	23	11	9	1	2	0	84
1909.....	1	5	2	4	9	11	11	12	14	4	0	3	76
1910.....	1	5	2	3	5	14	13	11	11	1	2	1	69
1911.....	1	0	2	4	5	15	12	13	12	6	2	2	74
1912.....	1	6	5	9	11	6	15	16	11	3	1	1	86
1913.....	1	6	9	3	6	9	18	13	8	1	0	2	76
1904-1913....	**16**	**31**	**39**	**48**	**74**	**116**	**164**	**155**	**115**	**27**	**11**	**18**	**814**
1894-1913....	21	52	70	68	114	180	256	256	143	34	20	31	1,245
Philadelphia, Philadelphia County, Pa.													
[Lat., 39° 57′ N.; long., 75° 09′ W. Elevation, 117 feet.]													
1872-1903....	1	12	27	47	109	140	195	138	60	19	12	3	763
1904.....	0	1	0	0	6	9		8	3	1	0	0	37
1905.....	0	0	4	6	7	7	19	10	3	2	1	1	51
1906.....	0	0	1	1	4	10	6	7	2	2	0	0	33
1907.....	0	0	3	3	6	4	8	5	4	0	0	0	33
1908.....	1	0	2	2	3	2	10	4	1	0	0	0	25
1909.....	0	2	0	3	3	4	3	0	0	2	1	0	18
1910.....	0	1	1	2	6	5	3	4	1	1	0	0	24
1911.....	0	1	2	0	5	6	9	13	1	0	0	0	37
1912.....	0	2	1	2	4	5	9	4	3	2	1	0	33
1913.....	0	1	0	3	2	4	7	6	3	2	0	0	28
1904-1913....	**1**	**8**	**14**	**22**	**46**	**56**	**74**	**61**	**21**	**12**	**3**	**1**	**319**
1872-1913....	2	20	41	69	155	196	269	199	81	31	15	4	1,082
Phoenix, Maricopa County, Ariz.													
[Lat., 33° 28′ N.; long., 112° 00′ W. Elevation, 1,108 feet.]													
1896-1903....	1	2	6	2	6	10	46	61	38	5	4	0	181
1904.....	0	0	1	0	1	0	8	14	4	1	0	0	29
1905.....	0	3	7	4	3	1	5	15	7	0	3	0	48
1906.....	0	0	1	1	1	0	11	9	0	0	0	0	23
1907.....	1	1	0	2	2	2	10	10	5	0	1	0	34
1908.....	0	0	0	1	1	1	16	12	4	0	1	3	39
1909.....	0	1	2	0	2	0	12	20	3	0	0	0	40
1910.....	0	0	0	0	1	2	5	12	1	1	3	0	25
1911.....	0	1	0	1	0	3	11	9	7	3	0	0	35
1912.....	0	0	0	1	2	4	9	6	2	4	0	0	28
1913.....	0	0	0	1	0	1	10	12	4	2	0	1	31
1904-1913....	**1**	**6**	**11**	**11**	**13**	**14**	**97**	**119**	**37**	**11**	**8**	**4**	**332**
1896-1913....	2	8	17	13	19	24	143	180	75	16	12	4	513
Pierre, Hughes County, S. Dak.													
[Lat., 44° 22′ N.; long., 100° 21′ W. Elevation, 1,572 feet.]													
1891-1903 [17]..	0	0	2	23	44	107	118	91	31	11	2	0	429
1904.....	0	0	0	1	3	7	9	8	0	0	0	0	28
1905.....	0	0	0	2	3	14	9	8	3	1	0	0	40
1906.....	0	0	0	2	7	6	5	7	5	0	0	0	32
1907.....	0	0	0	0	5	7	18	9	7	1	0	0	47
1908.....	0	0	1	2	4	9	11	9	0	1	0	0	37
1909.....	0	0	0	0	5	10	8	9	2	1	0	0	35
1910.....	0	0	2	0	1	9	9	9	2	2	0	0	34
1911.....	0	0	0	1	7	9	8	6	6	1	0	0	38
1912.....	0	0	0	4	8	6	7	7	2	1	0	0	35
1913.....	0	0	0	2	6	6	9	7	2	1	0	0	33
1904-1913....	**0**	**0**	**3**	**14**	**49**	**83**	**93**	**79**	**29**	**9**	**0**	**0**	**359**
1891-1913....	0	0	3	37	93	190	211	170	60	20	2	0	788

[17] January to June, inclusive, 1891, missing.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Pittsburgh, Allegheny County, Pa.

[Lat., 40° 32′ N.; long., 80° 02′ W. Elevation, 842 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1886–1903....	3	6	17	42	91	138	144	97	42	11	5	3	599
1904.....	0	2	3	2	7	10	9	8	2	2	0	0	45
1905.....	0	0	1	3	8	10	9	9	3	1	0	1	45
1906.....	0	0	0	3	5	14	8	13	5	1	0	0	49
1907.....	1	1	6	2	5	8	8	2	4	0	0	0	37
1908.....	2	0	4	3	9	9	14	7	1	0	0	0	49
1909.....	1	2	1	6	4	9	8	5	2	1	0	0	39
1910.....	1	0	2	1	1	4	6	3	9	1	0	0	28
1911.....	1	0	1	3	6	8	6	8	9	1	0	0	43
1912.....	0	0	2	8	4	7	13	9	7	2	0	0	52
1913.....	2	0	5	2	6	6	13	5	3	2	0	0	44
1904–1913....	**8**	**5**	**25**	**33**	**55**	**85**	**94**	**69**	**45**	**11**	**0**	**1**	**431**
1886–1913....	11	11	42	75	146	223	238	166	87	22	5	4	1,030

Port Crescent, Clallam County, Wash.

[Lat., 48° 08′ N.; long., 123° 41′ W. Elevation, 259 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1899–1903....	0	0	0	0	0	1	2	0	1	0	0	0	4
1904.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1905.....	0	0	0	0	2	1	2	0	0	0	0	1	6
1906.....	0	0	0	0	0	0	2	0	0	0	0	0	2
1907.....	0	0	0	0	0	0	1	0	0	0	0	0	1
1908.....	0	0	0	0	0	0	1	2	0	0	0	1	4
1909.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1910.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1911.....	0	0	0	0	0	0	0	2	1	0	0	0	3
1912.....	0	0	0	0	0	4	0	1	0	0	1	2	8
1913.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1904–1913....	**0**	**0**	**0**	**0**	**2**	**5**	**6**	**5**	**1**	**0**	**1**	**4**	**24**
1899–1913....	0	0	0	0	2	6	8	5	2	0	1	4	28

Port Huron, St. Clair County, Mich.

[Lat., 43° 00′ N.; long., 82° 26′ W. Elevation, 638 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1875–1903....	3	6	17	31	94	126	130	91	53	24	3	1	579
1904.....	0	2	3	1	2	4	5	6	6	2	0	0	31
1905.....	0	0	0	0	5	6	8	7	3	1	1	0	31
1906.....	0	1	0	3	6	9	8	9	1	2	0	0	39
1907.....	2	0	3	2	2	6	5	3	6	4	0	0	33
1908.....	0	0	2	2	5	8	4	5	0	1	2	0	29
1909.....	1	0	0	5	3	6	6	5	2	0	1	0	29
1910.....	0	0	1	4	2	2	7	7	2	2	0	0	27
1911.....	0	1	0	0	9	5	5	8	5	3	0	0	36
1912.....	0	0	0	4	8	5	6	4	3	2	0	0	32
1913.....	0	1	2	5	4	7	8	8	2	0	1	0	38
1904–1913....	**3**	**5**	**11**	**26**	**46**	**58**	**62**	**62**	**30**	**17**	**5**	**0**	**325**
1875–1913....	6	11	28	57	140	184	192	153	83	41	8	1	904

Portland, Cumberland County, Me.

[Lat., 43° 39′ N.; long., 70° 15′ W. Elevation, 103 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1871–1903....	0	2	5	13	32	68	87	59	33	11	3	1	314
1904.....	1	0	1	1	2	3	2	2	3	0	0	0	15
1905.....	0	0	0	0	0	2	1	3	1	0	0	0	7
1906.....	0	0	0	1	2	6	7	3	1	2	0	0	22
1907.....	0	0	1	0	0	5	7	1	3	0	0	0	17
1908.....	0	0	1	0	5	0	6	4	1	0	0	0	17
1909.....	0	0	0	1	1	2	3	2	0	0	0	0	9
1910.....	0	0	1	0	1	4	4	2	2	3	0	0	17
1911.....	0	0	2	0	5	3	6	1	1	0	0	0	18
1912.....	0	0	0	1	2	2	5	5	3	1	0	0	19
1913.....	0	0	0	0	0	2	4	4	1	0	0	1	12
1904–1913....	**1**	**0**	**6**	**4**	**18**	**29**	**45**	**27**	**16**	**6**	**0**	**1**	**153**
1871–1913....	1	2	11	17	50	97	132	86	49	17	3	2	467

Portland, Multnomah County, Oreg.

[Lat., 45° 32′ N.; long., 122° 43′ W. Elevation, 57 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1872–1903....	1	1	2	4	18	17	9	18	7	2	0	2	81
1904.....	0	1	0	0	1	0	0	1	0	0	0	0	3
1905.....	1	1	0	1	6	1	0	1	2	0	0	0	13
1906.....	0	1	0	0	1	0	2	0	0	1	0	0	5
1907.....	0	0	0	0	0	1	2	1	0	0	0	0	4
1908.....	0	0	0	0	0	0	0	0	1	0	0	0	1
1909.....	0	0	0	0	0	0	0	0	0	1	0	0	1
1910.....	0	0	1	0	0	1	1	1	1	1	0	0	6
1911.....	0	0	0	0	0	1	0	3	0	0	0	0	4
1912.....	0	0	0	2	3	1	3	1	0	0	2	0	12
1913.....	0	0	1	1	2	0	1	0	0	0	0	0	5
1904–1913....	**1**	**3**	**2**	**4**	**13**	**5**	**9**	**8**	**4**	**3**	**2**	**0**	**54**
1872–1913....	2	4	4	8	31	22	18	26	11	5	2	2	135

Pueblo, Pueblo County, Colo.

[Lat., 38° 18′ N.; long., 104° 36′ W. Elevation, 4,685 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1889–1903....	0	0	1	21	76	117	155	145	27	7	1	0	550
1904.....	0	0	0	1	11	15	14	17	5	0	0	0	63
1905.....	0	0	2	1	10	14	14	12	5	0	0	0	58
1906.....	0	0	0	4	6	12	17	8	7	0	0	0	54
1907.....	0	1	0	1	10	6	16	13	5	1	0	0	53
1908.....	0	1	1	3	4	6	18	8	1	1	0	0	43
1909.....	0	0	1	0	3	15	10	10	6	3	0	0	48
1910.....	0	0	1	5	5	8	14	13	2	0	0	0	48
1911.....	0	0	0	4	7	4	15	6	4	0	0	0	40
1912.....	0	0	0	3	2	9	12	10	3	1	0	0	40
1913.....	0	0	1	0	7	8	8	8	4	0	0	1	37
1904–1913....	**0**	**2**	**6**	**22**	**65**	**97**	**138**	**105**	**42**	**6**	**0**	**1**	**484**
1889–1913....	0	2	7	43	141	214	293	250	69	13	1	1	1,034

Raleigh, Wake County, N. C.

[Lat., 35° 45′ N.; long., 78° 37′ W. Elevation, 376 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1887–1903....	0	12	33	34	109	125	138	112	35	8	6	1	613
1904.....	1	2	4	2	9	11	11	7	3	0	0	0	50
1905.....	0	0	3	3	8	6	12	11	4	0	0	0	47
1906.....	0	1	0	2	5	12	12	14	4	0	1	0	51
1907.....	0	0	2	3	8	6	11	5	5	1	1	0	42
1908.....	0	0	3	3	4	7	13	7	2	0	1	1	41
1909.....	0	0	1	4	4	12	11	4	4	3	1	0	44
1910.....	1	1	1	5	6	8	15	10	7	1	1	0	56
1911.....	0	1	2	3	3	10	13	11	4	1	0	0	48
1912.....	0	1	1	3	7	8	9	9	6	1	0	0	45
1913.....	1	0	3	2	5	10	12	9	1	2	0	0	45
1904–1913....	**3**	**6**	**20**	**30**	**59**	**90**	**119**	**87**	**40**	**9**	**5**	**1**	**469**
1887–1913....	3	18	53	64	168	215	257	199	75	17	11	2	1,082

Rapid City, Pennington County, S. Dak.

[Lat., 44° 04′ N.; long., 103° 12′ W. Elevation, 3,234 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1888–1903....	0	0	2	24	66	148	139	110	30	8	0	0	527
1904.....	0	0	0	0	3	9	9	10	1	0	0	0	32
1905.....	0	0	0	0	1	9	11	1	2	0	0	0	24
1906.....	0	0	0	0	7	8	6	6	0	0	0	0	27
1907.....	0	0	0	1	4	9	12	6	.....	.....	0	0	[18] 32
1908.....	0	0	0	1	1	6	9	7	3	1	0	0	28
1909.....	0	0	0	0	4	17	12	9	5	1	0	0	48
1910.....	0	0	1	1	2	9	11	11	2	2	0	0	39
1911.....	0	0	0	4	8	8	10	9	6	1	0	0	46
1912.....	0	0	0	3	9	7	13	12	1	0	0	0	45
1913.....	0	0	0	0	7	12	9	8	2	0	0	0	38
1904–1913....	**0**	**0**	**1**	**10**	**46**	**94**	**102**	**79**	**22**	**5**	**0**	**0**	**359**
1888–1913....	0	0	3	34	112	242	241	189	52	13	0	0	886

[18] Total for 331 days.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Red Bluff, Tehama County, Cal.													
[Lat., 40° 10′ N.; long., 122° 15′ W. Elevation, 332 feet.]													
1882–1903....	2	7	9	9	20	13	6	4	11	9	2	3	95
1904.....	0	0	0	1	0	1	2	0	2	1	0	0	7
1905.....	0	0	2	0	2	2	0	0	0	0	0	0	6
1906.....	0	1	0	0	0	0	1	0	1	0	0	1	4
1907.....	0	0	0	0	0	4	0	0	0	1	0	0	5
1908.....	0	.....	0	0	2	0	0	0	0	0	0	0	2
1909.....	1	1	2	1	1	1	0	0	0	0	0	0	7
1910.....	1	0	0	0	2	0	0	0	0	0	0	0	3
1911.....	0	0	0	0	2	0	0	0	1	2	0	0	5
1912.....	1	0	1	2	3	1	1	0	0	1	0	0	10
1913.....	1	0	0	0	1	0	0	1	0	0	0	0	3
1904–1913....	**4**	**2**	**5**	**4**	**13**	**9**	**4**	**1**	**4**	**5**	**0**	**1**	**52**
1882–1913....	6	9	14	13	33	22	10	5	15	14	2	4	147
Richmond, Henrico County, Va.													
[Lat., 37° 32′ N.; long., 77° 27′ W. Elevation, 144 feet.]													
1898–1903....	1	2	11	7	36	34	48	38	17	2	2	0	198
1904.....	0	0	3	2	6	10	11	10	2	0	0	0	44
1905.....	0	0	3	5	10	5	13	9	4	0	0	0	49
1906.....	0	0	0	5	4	12	10	15	3	0	0	0	49
1907.....	0	0	2	2	7	6	8	8	7	1	0	0	41
1908.....	0	0	0	4	6	4	12	6	1	1	0	0	34
1909.....	1	1	1	4	3	14	3	4	2	1	1	0	35
1910.....	0	0	0	6	4	5	6	7	3	2	0	0	33
1911.....	0	0	2	5	6	10	7	13	4	1	1	0	49
1912.....	0	0	3	4	2	7	8	7	3	0	1	0	35
1913.....	0	0	3	2	6	9	15	7	3	1	0	0	46
1904–1913....	**1**	**1**	**17**	**39**	**54**	**82**	**93**	**86**	**32**	**7**	**3**	**0**	**415**
1898–1913....	2	3	28	46	90	116	141	124	49	9	5	0	613
Roseburg, Douglas County, Oreg.													
[Lat., 43° 13′ N.; long., 123° 20′ W. Elevation, 510 feet.]													
1878–1903....	0	0	3	7	21	10	6	11	5	4	1	0	68
1904.....	0	0	0	0	0	0	1	0	0	0	0	0	1
1905.....	0	0	0	1	1	0	0	0	0	0	0	1	3
1906.....	0	0	0	0	0	0	0	1	0	0	0	0	1
1907.....	0	0	2	0	1	0	1	0	0	0	0	0	4
1908.....	0	0	0	0	0	0	1	0	0	0	0	0	1
1909.....	0	0	0	0	0	0	0	0	1	0	0	0	1
1910.....	0	0	1	1	2	1	0	0	2	0	0	0	7
1911.....	0	0	0	0	0	1	1	0	2	0	0	0	4
1912.....	0	0	0	0	1	3	3	2	0	0	0	0	9
1913.....	0	0	0	0	0	1	0	1	1	1	0	0	4
1904–1913....	**0**	**0**	**3**	**2**	**5**	**6**	**7**	**4**	**6**	**1**	**0**	**1**	**35**
1878–1913....	0	0	6	9	26	16	13	15	11	5	1	1	103
Sacramento, Sacramento County, Cal.													
[Lat., 38° 35′ N.; long., 121° 30′ W. Elevation, 69 feet.]													
1878–1903....	2	3	8	10	15	5	2	8	11	2	3	3	72
1904.....	0	0	2	0	0	0	0	1	5	3	0	0	11
1905.....	0	1	0	0	1	0	0	1	0	0	0	0	3
1906.....	0	1	3	0	0	1	0	0	1	0	0	0	6
1907.....	0	0	2	0	1	1	0	0	0	1	0	1	6
1908.....	0	0	1	0	0	0	0	0	1	0	0	0	2
1909.....	0	0	1	0	0	0	0	0	0	0	0	0	1
1910.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1911.....	0	1	0	0	0	0	0	0	0	0	0	0	1
1912.....	1	0	1	0	0	0	0	0	0	0	0	0	2
1913.....	1	0	0	0	0	1	0	0	0	0	0	0	2
1904–1913....	**2**	**3**	**10**	**0**	**2**	**3**	**0**	**2**	**7**	**4**	**0**	**1**	**34**
1878–1913....	4	6	18	10	17	8	2	10	18	6	3	4	106

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
St. Louis, St. Louis County, Mo.													
[Lat., 38° 38′ N.; long., 90° 12′ W. Elevation, 567 feet.]													
1871–1903....	11	26	65	98	167	201	137	125	75	41	24	11	981
1904.....	0	2	8	4	7	7	12	7	8	1	0	0	56
1905.....	0	0	3	6	7	6	10	9	4	2	0	0	47
1906.....	1	2	1	5	8	7	7	10	4	0	1	0	46
1907.....	0	0	6	4	6	11	8	9	4	3	1	0	52
1908.....	0	1	3	5	14	9	9	5	3	0	1	0	50
1909.....	1	3	5	7	5	10	10	9	3	5	4	0	62
1910.....	0	0	1	6	7	11	9	10	8	0	1	0	53
1911.....	1	2	3	8	4	7	2	8	11	3	2	0	51
1912.....	0	1	1	6	8	11	11	12	5	5	1	0	61
1913.....	1	1	5	2	3	9	8	8	5	3	3	0	48
1904–1913....	**4**	**12**	**36**	**53**	**69**	**88**	**86**	**87**	**55**	**22**	**14**	**0**	**526**
1871–1913....	15	38	101	151	236	289	223	212	130	63	38	11	1,507
St. Paul, Ramsey County, Minn.													
[Lat., 44° 58′ N.; long., 93° 03′ W. Elevation, 837 feet.]													
1889–1903....	0	0	11	37	71	104	90	95	52	27	1	0	488
1904.....	0	0	0	0	5	8	4	4	3	2	0	0	26
1905.....	0	0	1	1	7	12	3	10	3	0	0	0	37
1906.....	0	0	0	2	10	5	9	5	6	0	0	0	37
1907.....	0	0	1	0	2	9	7	5	4	1	0	0	29
1908.....	0	0	0	1	7	9	5	2	5	0	0	0	29
1909.....	0	0	0	2	2	8	2	10	7	2	0	0	33
1910.....	0	0	0	1	0	1	3	6	3	1	0	0	15
1911.....	0	0	0	0	6	11	10	11	10	2	0	0	50
1912.....	0	0	0	4	7	2	7	9	2	0	0	0	31
1913.....	0	0	2	2	4	7	13	6	4	2	1	0	41
1904–1913....	**0**	**0**	**4**	**13**	**50**	**73**	**63**	**68**	**47**	**10**	**1**	**0**	**328**
1889–1913....	0	0	15	50	121	176	153	163	99	37	2	0	816
Salt Lake City, Salt Lake County, Utah.													
[Lat., 40° 46′ N.; long., 111° 54′ W. Elevation, 4,360 feet.]													
1874–1903....	3	5	11	22	58	58	88	93	32	19	5	3	397
1904.....	1	0	5	0	4	5	7	8	4	2	0	0	36
1905.....	0	0	6	5	5	2	7	11	7	0	1	0	44
1906.....	2	0	2	3	2	5	12	12	3	0	0	0	41
1907.....	1	2	1	6	6	8	9	9	3	5	0	0	50
1908.....	0	0	0	3	2	7	6	10	5	0	0	0	33
1909.....	3	1	1	1	3	7	7	15	5	2	0	0	45
1910.....	0	0	0	1	1	2	6	7	3	0	0	0	20
1911.....	2	0	1	2	1	2	1	4	4	0	0	0	17
1912.....	0	0	1	1	2	8	5	6	2	2	0	0	27
1913.....	1	0	0	1	3	11	12	7	6	2	0	0	43
1904–1913....	**10**	**3**	**17**	**23**	**29**	**57**	**72**	**89**	**42**	**13**	**1**	**0**	**356**
1874–1913....	13	8	28	45	87	115	160	182	74	32	6	3	753
San Antonio, Bexar County, Tex.													
[Lat., 29° 27′ N.; long., 98° 28′ W. Elevation, 701 feet.]													
1885–1903 [19]..	13	15	28	62	86	64	71	62	48	23	18	7	497
1904.....	0	0	2	3	9	5	5	5	8	2	0	1	40
1905.....	0	0	5	7	5	4	7	5	6	2	2	1	44
1906.....	1	1	2	7	6	5	8	3	8	2	0	3	46
1907.....	0	1	4	9	9	1	5	4	3	1	4	0	41
1908.....	0	3	3	6	7	3	14	9	5	4	1	2	57
1909.....	0	1	3	5	12	5	4	8	4	2	1	1	46
1910.....	0	0	1	4	5	5	4	2	8	1	1	1	32
1911.....	0	1	2	6	2	1	0	4	2	2	0	0	20
1912.....	0	2	2	1	4	3	4	2	4	0	0	1	23
1913.....	0	0	1	3	4	5	0	9	8	4	2	1	37
1904–1913....	**1**	**9**	**25**	**51**	**63**	**37**	**51**	**51**	**56**	**20**	**11**	**11**	**386**
1885–1913....	14	24	53	113	149	101	122	113	104	43	29	18	883

[19] Record for January and February, 1885, missing.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
San Diego, San Diego County, Cal. [Lat., 32° 43′ N.; long., 117° 10′ W. Elevation, 59 feet.]													
1872–1903....	2	6	9	5	3	1	3	9	2	3	0	1	44
1904.....	0	0	0	0	2	0	0	0	0	0	0	0	2
1905.....	0	1	2	0	0	0	0	0	1	0	1	0	5
1906.....	0	0	0	1	0	0	0	1	0	0	0	1	3
1907.....	0	0	0	0	0	0	0	0	0	1	0	0	1
1908.....	1	0	0	0	0	0	1	1	1	2	0	0	6
1909.....	1	0	1	0	0	0	0	0	0	0	0	0	2
1910.....	0	0	0	0	0	0	0	1	1	0	0	0	2
1911.....	0	0	0	0	0	0	3	0	0	0	0	2	5
1912.....	0	0	1	0	0	2	0	0	0	2	1	0	6
1913.....	0	0	0	0	0	0	0	3	0	0	0	0	3
1904–1913....	**2**	**1**	**4**	**1**	**2**	**2**	**4**	**6**	**3**	**5**	**2**	**3**	**35**
1872–1913....	4	7	13	6	5	3	7	15	5	8	2	4	79
San Juan, P. R. [Lat., 18° 29′ N.; long., 66° 07′ W. Elevation, 82 feet.]													
1899–1903....	1	0	0	12	35	41	40	39	47	47	15	7	284
1904.....	0	1	2	4	3	3	8	8	6	1	4	0	40
1905.....	0	0	0	1	3	6	8	10	11	12	3	2	56
1906.....	0	0	0	1	3	11	7	7	5	1	1	1	37
1907.....	0	0	0	1	4	9	6	7	11	12	1	0	51
1908.....	0	1	1	0	4	9	9	6	10	5	5	0	50
1909.....	1	0	0	0	3	5	3	11	8	4	3	0	38
1910.....	1	0	0	0	4	3	6	8	7	5	1	0	35
1911.....	0	0	0	3	11	4	9	5	12	12	6	4	66
1912.....	0	0	0	2	5	4	3	7	15	8	1	1	46
1913.....	0	0	1	0	4	7	6	7	10	16	2	0	53
1904–1913....	**2**	**2**	**4**	**12**	**44**	**61**	**65**	**76**	**95**	**76**	**27**	**8**	**472**
1899–1913....	3	2	4	24	79	102	105	115	142	123	42	15	756
Sandusky, Erie County, Ohio. [Lat., 41° 25′ N.; long., 82° 40′ W. Elevation, 629 feet.]													
1884–1903....	5	7	17	35	91	134	131	85	52	18	3	4	582
1904.....	1	3	2	1	3	3	8	5	3	1	0	0	30
1905.....	0	0	0	3	8	9	10	5	3	1	0	0	39
1906.....	1	0	0	2	6	9	9	12	2	2	0	0	43
1907.....	1	0	3	2	3	8	9	3	6	2	0	1	38
1908.....	0	0	5	3	11	7	10	6	3	0	1	0	46
1909.....	2	0	1	4	9	11	7	6	1	0	3	0	44
1910.....	0	0	1	2	4	3	6	5	6	1	1	0	29
1911.....	0	0	1	0	8	6	4	6	7	4	0	0	36
1912.....	0	0	3	4	4	8	12	11	4	2	0	0	48
1913.....	2	0	2	2	5	10	10	8	5	3	0	0	47
1904–1913....	**7**	**3**	**18**	**23**	**61**	**74**	**85**	**67**	**40**	**16**	**5**	**1**	**400**
1884–1913....	12	10	35	58	152	208	216	152	92	34	8	5	982
San Francisco, San Francisco County, Cal. [Lat., 37° 48′ N.; long., 122° 26′ W. Elevation, 155 feet.]													
1891–1903....	2	1	1	3	1	1	1	2	2	2	3	5	24
1904.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1905.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1906.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1907.....	0	0	0	0	0	0	0	0	0	1	0	1	2
1908.....	0	1	0	0	0	0	0	0	0	0	0	0	1
1909.....	0	1	0	0	0	0	0	0	0	0	0	0	1
1910.....	0	0	0	0	0	0	0	0	0	0	0	0	0
1911.....	0	1	1	0	0	0	0	0	0	0	0	0	2
1912.....	0	1	0	0	0	0	0	0	0	0	0	0	1
1913.....	1	0	0	0	0	0	0	0	0	0	0	0	1
1904–1913....	**1**	**4**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**8**
1891–1913....	3	5	2	3	1	1	1	2	2	3	3	6	82

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Santa Fe, Santa Fe County, N. Mex. [Lat., 35° 41′ N.; long., 105° 57′ W. Elevation, 7,013 feet.]													
1872–1903 [20]..	2	3	13	35	82	108	227	194	63	25	6	2	759
1904.....	0	0	1	0	6	12	16	17	12	1	0	0	65
1905.....	0	1	2	1	6	8	18	17	10	1	1	0	65
1906.....	0	2	3	5	6	6	24	17	11	3	0	0	77
1907.....	0	1	1	2	11	7	25	17	8	2	0	0	74
1908.....	0	1	2	5	6	6	31	18	5	1	0	0	75
1909.....	2	0	2	1	5	9	19	22	5	6	0	0	71
1910.....	1	0	4	3	5	11	20	19	10	2	1	0	76
1911.....	0	0	2	3	13	12	22	13	11	1	0	0	77
1912.....	0	1	5	4	6	19	21	17	4	1	0	0	78
1913.....	0	0	1	4	7	19	14	19	8	1	1	0	74
1904–1913....	**3**	**6**	**23**	**28**	**71**	**109**	**210**	**176**	**84**	**19**	**3**	**0**	**732**
1872–1913....	4	9	36	63	153	217	437	370	147	44	9	2	1,491
Sault Ste. Marie, Chippewa County, Mich. [Lat., 46° 30′ N.; long., 84° 21′ W. Elevation, 614 feet.]													
1888–1903 [21]..	0	0	6	11	40	41	[21] 84	68	64	20	3	0	337
1904.....	0	0	2	1	1	3	6	5	1	0	1	0	20
1905.....	0	0	1	1	2	4	2	3	2	1	0	0	16
1906.....	0	0	0	1	3	5	2	3	4	0	0	0	18
1907.....	0	0	2	0	2	2	3	5	3	0	0	0	17
1908.....	0	0	1	2	1	4	5	2	4	4	0	0	23
1909.....	0	0	0	0	1	2	4	2	1	1	2	0	13
1910.....	0	0	1	1	0	1	5	6	5	5	3	0	27
1911.....	0	0	1	0	6	6	3	3	1	1	1	0	22
1912.....	0	0	0	1	0	3	2	5	8	8	0	0	27
1913.....	0	0	1	2	2	4	7	6	2	2	0	0	26
1904–1913....	**0**	**0**	**9**	**9**	**18**	**34**	**39**	**40**	**31**	**22**	**7**	**0**	**209**
1888–1913....	0	0	15	20	58	75	123	108	95	42	10	0	546
Savannah, Chatham County, Ga. [Lat., 32° 05′ N.; long., 81° 05′ W. Elevation, 65 feet.]													
1876–1903 [22]..	15	22	53	72	142	214	282	273	77	11	9	9	1,179
1904.....	1	1	5	2	3	11	17	19	5	1	0	0	65
1905.....	0	2	2	7	12	6	18	9	8	0	0	1	65
1906.....	1	0	3	2	7	15	17	11	9	1	0	1	67
1907.....	0	1	1	4	9	11	19	21	8	1	1	1	77
1908.....	2	2	1	5	10	8	12	13	5	1	0	0	59
1909.....	1	2	3	2	8	11	11	10	1	1	1	0	51
1910.....	0	5	1	4	6	11	17	6	6	0	0	0	56
1911.....	0	0	0	1	2	15	11	10	10	2	0	0	51
1912.....	0	2	0	7	7	5	9	12	14	1	0	0	57
1913.....	1	2	2	3	5	8	21	11	3	0	1	1	58
1904–1913....	**6**	**17**	**18**	**37**	**69**	**101**	**152**	**122**	**69**	**8**	**3**	**4**	**606**
1876–1913....	21	39	71	109	211	315	434	395	146	19	12	13	1,785
Seattle, King County, Wash. [Lat., 47° 38′ N.; long., 122° 20′ W. Elevation, 125 feet.]													
1893–1903 [23]..	0	1	1	5	5	8	7	5	4	1	2	0	39
1904.....	0	2	1	0	0	1	1	0	0	0	0	0	5
1905.....	0	0	0	0	1	0	1	0	1	0	0	0	3
1906.....	0	0	1	0	0	4	1	0	0	1	0	0	7
1907.....	0	0	0	0	1	1	2	1	1	0	0	0	6
1908.....	0	0	2	0	1	1	2	2	0	0	0	0	8
1909.....	0	0	0	1	1	0	0	0	1	0	0	0	3
1910.....	0	0	0	0	0	2	0	0	0	0	0	0	2
1911.....	0	0	0	1	0	1	0	2	3	0	0	0	7
1912.....	0	0	1	0	1	4	1	1	0	1	1	1	11
1913.....	0	0	1	0	1	1	1	2	1	0	0	0	7
1904–1913....	**0**	**2**	**6**	**2**	**6**	**15**	**9**	**8**	**7**	**2**	**1**	**1**	**59**
1893–1913....	0	3	7	7	11	23	16	13	11	3	3	1	98

[20] Record for December, 1881, and from June, 1883, to November, 1884, inclusive, missing.
[21] Record begins with July, 1888.
[22] Record for 1876 and 1877 incomplete.
[23] Record begins with May, 1893.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Contd.

Sioux City, Woodbury County, Iowa.

[Lat., 42° 29′ N.; long., 96° 24′ W. Elevation, 1,135 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1890–1903....	0	0	13	45	74	109	99	90	53	25	1	0	509
1904.....	0	0	1	1	4	9	4	5	2	2	0	0	28
1905.....	0	0	1	2	9	10	6	10	4	1	2	0	45
1906.....	0	0	0	3	7	7	10	8	7	1	1	0	44
1907.....	1	0	0	0	7	9	15	9	6	4	0	0	51
1908.....	0	0	1	3	11	11	5	7	2	0	0	0	40
1909.....	0	1	0	3	5	14	6	11	4	3	2	0	49
1910.....	0	0	0	3	1	6	9	9	8	2	0	0	38
1911.....	0	0	0	3	3	12	12	9	6	3	0	0	48
1912.....	0	0	1	4	8	5	11	10	6	1	1	0	47
1913.....	0	0	1	5	10	6	10	10	4	0	0	0	46
1904–1913....	**1**	**1**	**5**	**27**	**65**	**89**	**88**	**88**	**49**	**17**	**6**	**0**	**436**
1890–1913....	1	1	18	72	139	198	187	178	102	42	7	0	945

Spokane, Spokane County, Wash.

[Lat., 47° 40′ N.; long., 117° 25′ W. Elevation, 1,939 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1890–1903....	0	0	2	4	16	21	23	13	8	1	0	0	88
1904.....	0	0	0	2	0	2	2	1	0	0	0	0	7
1905.....	0	0	0	0	3	4	5	2	1	1	0	0	16
1906.....	0	0	0	0	3	1	4	1	0	0	0	0	9
1907.....	0	0	0	2	4	0	4	3	1	0	0	0	14
1908.....	0	0	0	2	1	3	2	1	1	1	0	0	11
1909.....	0	0	0	0	0	3	2	0	2	0	0	0	7
1910.....	0	0	0	0	1	1	1	1	2	1	0	0	7
1911.....	0	0	0	0	0	6	1	5	2	0	0	0	14
1912.....	0	0	0	2	1	3	3	0	0	0	0	0	9
1913.....	0	0	0	0	2	4	2	5	1	0	0	0	14
1904–1913....	**0**	**0**	**0**	**8**	**15**	**27**	**26**	**19**	**10**	**3**	**0**	**0**	**108**
1890–1913....	0	0	2	12	31	48	49	32	18	4	0	0	196

Springfield, Sangamon County, Ill.

[Lat., 39° 48′ N.; long., 89° 39′ W. Elevation, 644 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1880–1903....	3	13	45	101	182	218	145	140	95	43	23	8	1,016
1904.....	0	1	6	4	4	9	8	5	4	1	0	0	42
1905.....	0	0	4	6	7	6	7	6	3	3	0	0	42
1906.....	1	0	0	5	9	6	7	10	4	1	1	1	45
1907.....	3	0	8	5	8	9	14	10	2	2	0	1	62
1908.....	0	1	4	7	15	10	7	5	1	0	2	0	52
1909.....	2	3	2	6	6	11	6	4	4	4	0	0	52
1910.....	0	0	3	4	8	11	12	5	7	3	2	0	55
1911.....	1	1	4	6	6	8	6	5	12	2	3	0	54
1912.....	2	0	2	8	11	12	11	8	4	4	1	0	63
1913.....	1	0	5	3	5	5	6	10	3	1	3	0	42
1904–1913....	**10**	**6**	**38**	**54**	**79**	**87**	**84**	**63**	**44**	**21**	**16**	**2**	**509**
1880–1913....	13	19	83	155	261	305	229	208	139	64	39	10	1,525

Springfield, Greene County, Mo.

[Lat., 37° 12′ N.; long., 93° 18′ W. Elevation, 1,324 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1888–1903....	10	21	60	106	146	153	145	136	67	41	29	16	930
1904.....	1	2	8	6	8	13	14	7	3	1	0	1	64
1905.....	0	0	2	4	12	8	10	10	8	4	2	0	60
1906.....	1	1	3	5	10	11	11	11	7	1	1	0	62
1907.....	3	1	2	6	10	12	5	5	4	4	0	0	52
1908.....	0	3	3	6	9	12	5	9	2	0	4	0	53
1909.....	3	2	4	6	6	17	14	3	5	2	3	1	66
1910.....	0	0	1	5	7	10	14	7	10	3	0	1	58
1911.....	0	1	2	7	3	7	10	5	6	4	3	0	48
1912.....	1	2	1	6	7	9	11	8	7	4	1	0	57
1913.....	3	2	4	4	7	9	7	6	5	2	3	0	52
1904–1913....	**12**	**14**	**30**	**55**	**79**	**108**	**101**	**71**	**57**	**25**	**17**	**3**	**572**
1888–1913....	22	35	90	161	225	261	246	207	124	66	46	19	1,502

[24] Record begins with April, 1890.

Tampa, Hillsborough County, Fla.

[Lat., 27° 57′ N.; long., 82° 27′ W. Elevation, 67 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1890–1903 [24]..	14	20	30	35	59	150	164	191	79	12	5	6	765
1904.....	3	3	9	5	5	20	31	26	17	3	1	0	123
1905.....	0	0	6	4	19	17	27	23	15	3	0	0	114
1906.....	2	0	1	2	12	18	27	19	11	2	0	0	94
1907.....	0	2	0	1	11	11	22	23	20	2	1	2	95
1908.....	1	1	0	4	6	16	13	22	9	1	0	0	73
1909.....	2	3	0	3	10	18	16	17	7	0	0	1	77
1910.....	1	2	2	3	5	18	24	23	9	7	0	0	94
1911.....	0	0	1	1	8	14	21	21	17	5	2	1	91
1912.....	1	1	4	5	13	19	22	17	15	4	0	0	101
1913.....	0	1	1	0	8	13	26	19	11	2	0	1	82
1904–1913....	**10**	**13**	**24**	**28**	**97**	**164**	**229**	**210**	**131**	**29**	**4**	**5**	**944**
1890–1913....	24	33	54	63	156	314	393	401	210	41	9	11	1,709

Tatoosh Island, Clallam County, Wash.

[Lat., 48° 23′ N.; long., 124° 44′ W. Elevation, 86 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1884–1903 [25]..	0	0	0	0	1	3	1	3	6	7	10	10	(41)
1904.....	0	3	1	0	0	0	0	0	0	0	1	0	5
1905.....	1	0	0	0	1	0	1	0	3	2	0	0	8
1906.....	2	0	0	0	0	0	2	0	0	2	1	1	8
1907.....	0	0	0	0	0	0	2	0	0	0	1	0	3
1908.....	0	0	0	0	0	0	0	1	0	0	0	0	1
1909.....	0	0	0	0	0	0	0	0	0	1	2	1	4
1910.....	0	0	0	0	0	0	0	0	0	1	0	0	1
1911.....	0	0	0	1	0	0	0	0	2	0	0	0	3
1912.....	0	0	0	0	0	2	0	1	1	1	1	4	10
1913.....	1	0	0	0	0	0	0	1	4	0	2	2	10
1904–1913....	**4**	**3**	**1**	**1**	**1**	**2**	**5**	**3**	**10**	**7**	**8**	**8**	**53**
1884–1913....	4	3	1	1	2	5	6	6	16	14	18	18	94

Toledo, Lucas County, Ohio.

[Lat., 41° 40′ N.; long., 83° 34′ W. Elevation, 628 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1871–1903....	2	7	32	57	139	194	170	111	72	32	10	6	832
1904.....	0	2	3	1	3	5	6	6	7	0	0	0	33
1905.....	0	0	1	2	6	5	10	4	2	0	1	0	31
1906.....	0	1	0	2	5	9	10	10	3	2	0	0	42
1907.....	2	0	4	3	2	11	8	2	7	3	0	1	43
1908.....	0	0	4	3	11	6	8	8	0	0	1	0	41
1909.....	1	0	0	5	8	10	9	7	3	0	4	0	47
1910.....	0	0	0	6	4	4	7	3	4	2	1	0	31
1911.....	0	1	0	1	6	6	6	7	6	8	0	0	41
1912.....	0	0	0	4	6	7	13	10	2	2	2	0	46
1913.....	3	0	2	4	3	10	14	7	4	1	0	0	48
1904–1913....	**6**	**4**	**14**	**31**	**54**	**73**	**91**	**64**	**38**	**18**	**9**	**1**	**403**
1871–1913....	8	11	46	88	193	267	261	175	110	50	19	7	1,235

Topeka, Shawnee County, Kans.

[Lat., 39° 3′ N.; long., 95° 41′ W. Elevation, 983 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1888–1903....	2	4	31	58	105	100	91	99	51	26	4	4	575
1904.....	0	0	2	4	4	10	14	8	6	5	9	0	62
1905.....	0	0	4	2	9	7	9	6	8	1	1	0	47
1906.....	1	0	3	4	6	8	8	11	5	0	1	0	47
1907.....	2	3	6	2	5	9	9	10	8	3	0	1	58
1908.....	0	0	2	4	10	13	8	8	0	2	3	0	50
1909.....	1	1	3	5	11	11	13	2	5	2	3	1	58
1910.....	0	0	0	3	10	8	7	9	7	2	0	0	46
1911.....	2	1	2	7	4	6	8	7	10	4	2	0	53
1912.....	0	0	1	3	6	8	9	10	5	4	1	0	47
1913.....	0	0	3	2	9	5	5	6	6	6	2	0	44
1904–1913....	**6**	**5**	**26**	**36**	**74**	**85**	**90**	**77**	**60**	**29**	**22**	**2**	**512**
1888–1913....	8	9	57	94	179	185	181	176	111	55	26	6	1,087

[25] Record missing from August, 1898, to November, 1902, inclusive.

Table of numbers of thunderstorms recorded at Weather Bureau stations, by months and years, from the beginning of observations to 1913, inclusive—Concld.

Vicksburg, Warren County, Miss.

[Lat., 32° 22′ N.; long., 90° 53′ W. Elevation, 247 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1885–1903....	35	50	78	76	96	161	190	135	55	18	24	19	937
1904.....	1	1	8	3	8	10	16	17	4	0	0	1	69
1905.....	2	1	4	8	7	11	6	7	7	1	0	0	54
1906.....	2	1	5	3	5	8	9	12	11	0	2	0	58
1907.....	2	4	1	9	11	8	8	9	4	2	1	2	61
1908.....	1	4	1	9	6	13	12	11	7	1	3	1	69
1909.....	1	8	6	8	12	12	8	6	6	1	1	0	69
1910.....	1	4	2	6	6	12	10	9	8	4	2	2	66
1911.....	0	2	2	11	5	11	12	5	6	1	2	3	60
1912.....	3	3	6	9	7	13	18	14	4	1	2	2	82
1913.....	9	5	6	4	9	11	12	11	11	1	1	0	80
1904–1913....	**22**	**33**	**41**	**70**	**76**	**109**	**111**	**101**	**63**	**12**	**14**	**11**	**668**
1885–1913....	57	83	119	146	172	270	301	236	123	30	38	30	1,605

Walla Walla, Walla Walla County, Wash.

[Lat., 46° 2′ N.; long., 118° 20′ W. Elevation, 1,000 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1886–1903....	0	0	2	3	17	21	25	15	7	1	0	0	91
1904.....	0	0	0	2	0	3	5	1	1	0	0	0	12
1905.....	0	0	0	0	3	4	2	.....	1	0	0	0	[a] 10
1906.....	0	0	0	0	3	1	6	4	0	0	0	0	14
1907.....	0	0	0	0	2	[b] 0	.....	2	1	0	0	0	[a] 5
1908.....	0	0	0	0	0	0	2	2	1	0	0	0	[a] 5
1909.....	0	0	1	0	0	2	0	1	0	1	0	0	5
1910.....	0	0	0	0	0	0	1	1	3	0	0	0	5
1911.....	0	0	0	0	3	4	0	1	2	0	0	0	10
1912.....	0	0	0	1	1	3	1	1	0	0	0	0	7
1913.....	0	0	0	1	2	7	1	4	0	0	0	0	15
1904–1913....	**0**	**0**	**1**	**4**	**14**	**24**	**18**	**17**	**9**	**1**	**0**	**0**	**88**
1886–1913....	0	0	3	7	31	45	43	32	16	2	0	0	179

Washington, D. C.

[Lat., 38° 54′ N.; long., 77° 3′ W. Elevation, 112 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1872–1903 [26]..	3	9	27	52	143	173	214	139	57	14	8	1	840
1904.....	0	0	0	2	3	10	14	6	4	1	0	0	40
1905.....	0	0	1	4	8	9	11	10	1	0	0	0	44
1906.....	0	1	1	4	5	9	11	11	4	0	0	0	46
1907.....	0	0	3	2	4	3	9	6	8	2	1	1	39
1908.....	2	0	1	1	6	4	11	4	2	0	0	0	31
1909.....	0	1	1	5	2	8	8	5	1	1	1	0	33
1910.....	0	1	2	7	5	7	6	2	4	1	1	0	36
1911.....	0	2	5	0	5	8	8	12	4	0	0	0	44
1912.....	0	2	1	6	5	8	10	3	6	0	0	0	41
1913.....	1	0	2	2	5	6	9	8	3	2	0	0	38
1904–1913....	**3**	**7**	**17**	**33**	**48**	**72**	**97**	**67**	**37**	**7**	**3**	**1**	**392**
1872–1913....	6	16	44	85	191	245	311	206	94	21	11	2	1,232

Wichita, Sedgwick County, Kans.

[Lat., 37° 41′ N.; long., 97° 20′ W. Elevation, 1,358 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1888–1903 [27]..	2	8	35	77	134	127	131	126	79	43	4	3	769
1904.....	0	0	4	6	14	14	14	7	5	2	0	0	66
1905.....	0	0	5	4	14	8	6	7	8	2	1	0	55
1906.....	0	0	3	6	10	10	13	11	8	2	0	0	63
1907.....	1	2	1	2	7	10	7	7	8	3	0	0	48
1908.....	0	0	0	3	10	14	8	9	5	2	2	0	53
1909.....	0	2	4	7	6	14	11	6	2	3	4	1	60
1910.....	0	1	0	3	11	7	8	9	8	2	0	0	49
1911.....	1	2	2	5	4	5	8	6	10	1	0	0	44
1912.....	0	0	1	7	9	7	12	9	4	5	1	0	55
1913.....	0	1	1	3	5	8	8	2	3	5	2	0	38
1904–1913....	**2**	**8**	**21**	**46**	**90**	**97**	**95**	**73**	**61**	**27**	**10**	**1**	**531**
1888–1913....	4	16	56	123	224	224	226	199	140	70	14	4	1,300

Williston, Williams County, N. Dak.

[Lat., 48° 9′ N.; long., 103° 35′ W. Elevation, 1,896 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1883–1903....	0	0	0	18	47	114	117	86	19	5	0	0	406
1904.....	0	0	0	2	3	7	5	3	2	0	0	0	22
1905.....	0	0	0	0	2	6	7	9	2	0	0	0	26
1906.....	0	0	0	0	1	.....	.....	6	1	0	0	0	.....
1907.....	0	0	0	0	2	5	5	5	1	0	0	0	18
1908.....	0	0	0	1	4	7	4	5	2	0	0	0	23
1909.....	0	0	0	0	2	5	4	1	3	0	0	0	15
1910.....	0	0	1	1	1	7	3	4	0	0	0	0	17
1911.....	0	0	0	1	3	7	6	7	4	1	0	0	29
1912.....	0	0	0	0	2	6	10	6	2	1	0	0	27
1913.....	0	0	0	0	3	10	5	7	1	0	0	0	26
1904–1913....	**0**	**0**	**1**	**5**	**23**	**60**	**49**	**53**	**18**	**2**	**0**	**0**	**211**
1883–1913....	0	0	1	23	70	174	166	139	37	7	0	0	617

Wilmington, New Hanover County, N. C.

[Lat., 34° 14′ N.; long., 77° 57′ W. Elevation, 78 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1871–1903....	16	24	59	92	145	204	263	198	61	44	12	10	1,128
1904.....	1	2	9	5	4	13	19	15	4	0	0	0	72
1905.....	0	1	1	5	8	2	15	7	7	2	0	0	48
1906.....	0	3	1	4	8	12	13	14	3	2	2	1	63
1907.....	0	1	2	3	5	10	14	10	5	1	0	0	51
1908.....	0	0	4	6	9	9	8	12	3	3	0	0	54
1909.....	0	3	1	2	5	10	7	7	0	3	2	0	40
1910.....	1	2	1	3	8	10	14	10	8	0	0	0	57
1911.....	0	0	2	1	1	12	6	10	7	0	0	0	39
1912.....	1	2	0	3	6	2	8	10	5	0	0	0	37
1913.....	1	1	2	0	3	9	13	13	4	4	0	0	50
1904–1913....	**4**	**15**	**23**	**32**	**57**	**89**	**117**	**108**	**46**	**15**	**4**	**1**	**511**
1871–1913....	20	39	82	124	202	293	380	306	107	59	16	11	1,639

Winnemucca, Humboldt County, Nev.

[Lat., 40° 58′ N.; long., 117° 43′ W. Elevation, 4,291 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1885–1903....	0	1	4	7	36	38	39	38	14	5	1	1	184
1904.....	0	0	2	0	0	2	7	5	3	1	0	0	20
1905.....	0	0	1	1	4	2	1	4	0	0	0	0	13
1906.....	0	0	1	1	1	1	4	5	0	0	0	0	13
1907.....	0	0	0	2	2	6	2	1	2	2	0	0	17
1908.....	0	.....	0	0	1	2	5	2	5	0	1	0	16
1909.....	0	0	0	0	1	0	2	1	2	0	0	0	6
1910.....	0	0	1	0	0	2	1	0	0	0	0	0	4
1911.....	0	0	0	2	3	8	2	1	0	0	0	0	16
1912.....	0	0	0	0	2	3	2	2	1	1	0	0	11
1913.....	0	0	1	0	3	7	7	7	1	0	0	0	26
1904–1913....	**0**	**0**	**6**	**6**	**17**	**33**	**33**	**28**	**14**	**4**	**1**	**0**	**142**
1885–1913....	0	1	10	13	53	71	72	66	28	9	2	1	326

[a] For 11 months. [b] For 24 days. [26] Record for January and February, 1872, missing. [27] Record begins with July, 1888.

NEW HYPSOMETRIC MAP OF THE RUSSIAN EMPIRE.

Lieut. Col. Jules de Shokalsky, president of the Imperial Geographical Society of St. Petersburg (now Petrograd), has just sent us copies of his beautifully shaded and lithographed hypsometric map of the Russian Empire,[1] which presents the general topographic features of the empire by means of 15 shades among the three colors blue, green, and brown—and on a scale of 1:12,600,000 or, about 200 miles to the inch.

The gigantic proportions of the Empire and the lands falling under its influence are admirably impressed upon the reader of this chart. Extending from the longitude of Berlin and Copenhagen on the west (about 18° W. of Pulkova) to Bering Strait on the east (about 160° E. of Pulkova), from Franz Josef Land (80° N.) on the north to the latitude of Korea and Peshawar (about 34° N.) on the south, this chart embraces an area almost double that of the United States and with as great a variety of topography.

The use of a deep green for those land areas below mean sea level about the Caspian Sea, of lighter greens for areas between sea level and 500 meters above, together with 7 shades of brown for altitudes between 500 meters and the summits of the Himalayas, is in accord with international usage and serves to develop the pronounced hypsometric contrasts of the Empire. Americans will be surprised to find such a large percentage of the total area lying below 500 meters (1,640 feet) above sea level; from the Baltic to Rasnoïarsk, or over a stretch of 70° of longitude along the parallel of 60° N., the Trans-Siberian Railway does not exceed this altitude save for the short crossing of the Urals (about 500 meters) at Ekaterinburg.

As a whole, the map is not unduly loaded with place names (those given are in Russian), and the general effect of the above colors, together with five shades of blue indicating the topography of the ocean floor, is very pleasing. The only disturbing feature of the map is the heavy double black line showing the courses of the single-track Russian railroads. Many also will find it inconvenient to have to correct the published longitudes in order to bring this map with its 0° meridian at Pulkova into harmony with the standard Greenwich meridian; but when consulting this map alone it is also a convenience to have the meridians numbered from a prime meridian that is shown on the map itself.

All students of Asiatic meteorology, climatology, and geography will find this map an indispensable aid in securing a proper idea of the topographic features which are such an important factor in determining the weather, climate, and human activities of the great Slavic Empire and its Mongolian neighbors. We all owe the skilled and indefatigable compiler our thanks for this convenient map, and it is to be hoped that an English edition of this chart may soon appear in equal perfection.—C. A. jr.

[1] Carte hypsométrique de l'Empire Russe. Essai de représentation du relief de l'Empire, par J. de Schokalsky. Échelle, 1:12,600,000. Size, between neat lines, 46.3×68.1 cm. (18¼×26¾ inches). Lithographed in 4 colors.

THE HOTTEST REGION IN THE UNITED STATES.

Under this caption we presented in the June, 1915, REVIEW an interesting article by Mr. George H. Willson, wherein the statement is made that the highest temperature at Greenland ranch, Death Valley, Inyo County, Cal., was 134° F. We have just received through Mr. Willson the following statement by F. W. Corkill, mill superintendent of the Pacific Borax Co.:

> Regarding the temperature of 134°F., which was recorded [at the Greenland ranch] on July 10, 1913, I will state that this record should be considered correct. I remember the day very distinctly, as a man by the name of Busch perished in the valley north of the ranch that day on account of the heat. I do not know in which direction the wind was blowing on that day, but it was blowing very hard from either the north or the south. The chauffeur who was with Mr. Busch at the time he perished also very nearly lost his life. I saw him a few days later and he said that a terrific wind prevailed in the valley on that day.

RELATION BETWEEN DEPARTURES FROM THE NORMAL IN THE STRENGTH OF THE TRADE WINDS OF THE ATLANTIC AND THOSE IN THE WATER LEVEL OF THE NORTHERN EUROPEAN SEAS.[1]

By P. H. GALLÉ.

[Reprinted from Science Abstracts, Sec. A, June 25, 1915, § 649.]

Mean values from Norwegian, Dutch, German, and Finnish tide gages disclose an annual periodicity in the water level of the North Sea and Baltic showing a minimum in spring and a maximum in autumn, with an amplitude of about 18 cm. The author considers it probable that these fluctuations are caused by fluctuations in the strength of the North Atlantic current, which itself is a branch of the Gulf Stream. There is evidence that fluctuations in the strength of the Gulf Stream are closely associated with changes in the strength of the trade winds, and as observations of the trade winds are more numerous than current observations, an attempt is made to ascertain the correlation between the North Sea water level and the trade-wind strength. Curves showing the annual variations of these two elements lend support to the theory that monthly fluctuations in the strength of the northeast trade winds are responsible for the monthly fluctuations in the water level of the North Sea and Baltic, there being a time lag of about two and one-half months in the action. In addition to this effect by the distant trade winds it is found that the local winds in the neighborhood of the entrance to the Baltic from the North Sea also produce some effect on the water level.—*J. S. Dines.*

THE ROBINSON ANEMOMETER.[2]

By K. SCHREBER.

[Reprinted from Science Abstracts, Sec. A, June 25, 1915, § 650.]

The results of experiments to determine the constants of a small cup anemometer (cups, 38 mm. in diameter; arms, 45 mm. long) are described. The anemometer was mounted in the center of a box 35×35×50 cm. in dimensions, of which one end was open, while the opposite end could be opened or closed at will. The box was placed in the middle of the wind channel of the Aerodynamical Institute at Aachen, and arrangements were made for recording automatically the time at which each revolution, or, if desired, each quarter revolution, of the cups was completed. In order to determine the constants of the anemometer, the following general relation between the angular velocity ω of the cups and the velocity v of the air passing them was taken, it being assumed that the quantities a, b, c, d, e, and f are constants of the instrument, independent of v and ω—

$$d\omega/dt = a + b\omega + cv + d\omega^2 + ev\omega + fv^2.$$

[1] See Proc., K. Akad., Amsterdam, Apr. 23, 1915, 17:1147–1158.
[2] See Meteorol. Ztschr., August, 1914, 31:373–380.

In order to determine the constants, two sets of experiments were carried out. In the first set the cups were made rapidly to rotate by opening the movable lid of the box and passing an air current through the wind channel; then the lid was suddenly closed, thus making v zero, and the motion of the cups was recorded from that instant until the cups came to rest. The general equation reduces to—

$$d\omega/dt = a + b\omega + d\omega^2.$$

The constants a, b, and d were determined from the results of the experiments. In the second set of experiments, the cups being initially at rest and the lid closed, a *constant* current was passed along the channel. The lid was then opened, and the motion of the cups began to be recorded from that instant. The general equation

$$d\omega/dt = (a + cv + fv^2) + (b + ev)\omega + d\omega^2$$

could be written

$$d\omega/dt = a' + b'\omega + d\omega^2,$$

where a', b' are constants depending on the constant velocity, an equation similar to the preceding. In this way all the constants of the general equation could be deduced, and the final result is

$$(t+4.9)d\omega/dt = -1.76 - 0.667\omega + 0.50v - 0.098\omega^2 + 0.140\omega v + 0.84v^2.$$

The interesting case for meteorologists is that of the steady state when $d\omega/dt$ is zero, and the anemometer is rotating uniformly with angular velocity ω in a steady wind velocity of v. The relation between ω and v is then found by equating the right-hand side of the equation to zero. For values of v greater than 3 meters per second the solution reduces approximately to $v = 0.90 + \omega/3.74$, which gives a linear relation between the wind velocity and the rotation of the cups.—*R. Corless.*

REPORT OF THE WORK CARRIED OUT BY THE STEAMSHIP "SCOTIA," 1913.[1]

By G. I. TAYLOR.

[Reprinted from Science Abstracts, Sec A, June 25, 1915, § 653.]

* * * D. J. Matthews [hydrographer to the expedition] obtained full observations dealing with the bathymetry, salinity, temperature, and ocean currents of the area, and noted the position of all the ice observed. The observations indicate the conditions at the boundary of the cold, relatively fresh and slow-moving Labrador current which flows southward and southeastward from Davis Strait into the Atlantic, and the warm, saline and more rapidly-flowing Gulf stream, which flows across the path of the Labrador current from west to east and compels the latter to dive below.

Taylor's report [of the meteorologist] is noteworthy for the fact that on 14 separate occasions he was able to raise a kite carrying self-recording meteorological instruments from the deck of the *Scotia*, and to deduce from the records obtained important results with regard to the rate of propagation of temperature changes from the surface to the upper air, showing that the distribution of temperature in height is due to the action of eddies and resembles the process of heat conductivity in its mode of operation. New results regarding fog at sea are also obtained. In four of the kite ascents there was no fog, and the temperature uniformly fell with height (positive temperature gradient). The other 10 cases were associated with negative temperature gradients, and in 9 of them fog was noted to be present. Fog production appears to depend upon the mixing by eddy conductivity of layers of different temperatures and humidities, rather than upon the cooling below the dew point of a homogeneous mass of air. With regard to the suggested detection of the presence of icebergs from their effect upon the temperature of the sea, the conclusion is reached that in the regions visited by the *Scotia* the results obtained do not bear out the suggestion.—*R. Corless.*

[1] Report to the Board of Trade, London, 1914, 141 p. 4°. Text.

RADIUM CONTENT OF WATER FROM GULF OF MEXICO.[1]

By S. J. LLOYD.

[Reprinted from Science Abstracts, Sec. A, July 26, 1915, § 863.]

The growing recognition of radium as an important factor in geological processes has led to a multiplication of analyses of rocks and soils for that substance. With the object of obtaining further evidence on the question of the distribution of radium in the ocean, which at a minimum estimate contains 1,000 tons of radium, the author has made a careful examination of the water of the Gulf of Mexico. The measurements were made in the usual type of vacuum emanation electroscope and the results, with those of other observers, are included in the following table:

Observer.	Sea.	Radium per liter of water.
		Grams.
Joly	Various oceans	17.0×10^{-12}
Eve (1907)	North Atlantic	0.3×10^{-12}
Do	do	0.9×10^{-12}
Satterly	English sea waters	1.0×10^{-12}
Lloyd	Gulf of Mexico	1.7×10^{-12}

Excluding Joly's abnormally high results, an average value for the radium content of 1 liter of sea water is 1.2×10^{-12} gm., representing a total amount of 1,400 tons in the sea. According to the author, 100 liters of sea water should contain from 0.3 to 0.5 milligram of uranium.—*A. B. Wood.*

[1] Amer. jour. sci., May, 1915, (4) 39:580-582.

DISCUSSION ON ANTARCTIC METEOROLOGY.[2]

This discussion was opened by G. C. Simpson, briefly summarizing the general circulation of the atmosphere in the Southern Hemisphere as given in the textbooks, in Lockyer's "Southern Hemisphere surface air circulation," and Meinardus's "Discussion of the results of the *Gauss* Antarctic expedition."

1. Dr. Lockyer suggests an intense anticyclone over Antarctica, from which cold air feeds into a series of large cyclones circulating the southern ocean and having their centers near latitude 60°S. The cyclones are supposed to be so large that while their southern extremities sweep over the edge of Antarctica their northern extremities reach to latitude 40°S., and so dominate the weather of Tasmania and New Zealand and to some extent that of South Australia.

[2] *Reprinted from* Report of the Eighty-fourth Meeting of the British Association for the Advancement of Science, Australia, 1914. London, 1915. p. 302.

Prof. Meinardus's scheme[2] also includes a series of cyclones traveling from west to east over the southern ocean; but he gives strong reasons against the presence of an anticyclone over Antarctica. His chief objection to such an anticyclone is that anticyclonic conditions are accompanied by an excess of evaporation over precipitation; hence it would be impossible to account for the excess of precipitation which gives rise to the large glaciers and snowfields discharging the known large quantities of ice.

2. The simultaneous observations made at Cape Evans, Cape Adare, and Framheim were then considered to investigate the processes which are at work in the Ross Sea area. The chief conclusions were: The high southeasterly winds—commonly called blizzards [in the literature of Antarctica]—are not caused by cyclones passing into Ross Sea, but are the result of the large differences of temperature which exist in the lower atmosphere over the Barrier and Ross Sea. The cloud observations show that

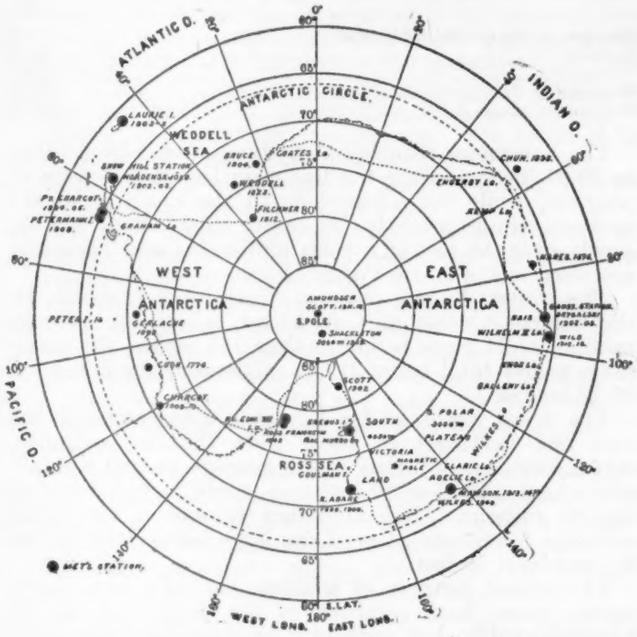

FIG. 1.—Location of meteorological stations within the South Polar Regions.

air feeds into the Antarctic at high levels and passes north again in the "blizzards." Meinardus's objection that in such a circulation precipitation would not exceed evaporation was shown not to hold, because of the great cooling of the air due to radiation. The air while sinking loses so much heat by radiation that, when forcibly made to rise again in the "blizzards," saturation is reached at a much lower level than that at which the air entered. Thus anticyclonic conditions are consistent with an excess of precipitation.

3. The existence of a belt of cyclones between Antarctica and Australia was then considered. Curves showing barometer and wind observations at the *Gauss* winter quarters were shown. From them it was seen that during the passage of deep waves of pressure there is practically no variation of the wind direction at that station. In most cases the wind blows a gale from the east both while the barometer falls rapidly and while it makes an equally rapid recovery. At present it appears quite impossible to reconcile the wind and barometer observations with any system of circulation of wind about a center of low pressure moving from the west to the east. Further, the simultaneous barometer observations at Melbourne, The Bluff, New Zealand, and at Cape Adare were examined without finding any certain indication of the same cyclone affecting the northern and the southern stations.

4. The monthly departures from the pressure normals at Cape Evans were compared with corresponding values for stations in Australasia, and an important negative correlation was found.

5. The importance of a permanent meteorological station on Antarctica was urged.

[2] See this REVIEW, April, 1914, 42:223-230.—C. A., Jr.

LOW TEMPERATURE OF THE SOUTHERN HEMISPHERE.[1]

While discussing at the Australian meeting of the British Association for the Advancement of Science certain other physical features of Antarctica, Dr. G. C. Simpson made the following comments on the cause of the relative difference in temperature between the Northern and Southern Hemispheres:

"I think we do not sufficiently realize that the Southern Hemisphere is much colder than the Northern Hemisphere, and the reason for this difference is certainly not understood by scientists. When we think of the temperature of a place we think of the temperature in the lower atmosphere. Now, the mere passage of light through the atmosphere will not warm it. The main method by which the atmosphere becomes warmed up is by the sun shining on something it can warm. Now, in the Northern Hemisphere there are large masses of land which can absorb the sun's energy, and then give the heat to the atmosphere. In the Southern Hemisphere, on the contrary, the whole mass of land within the Antarctic Continent [Antarctica] is covered with ice, which is practically a perfect reflector, and therefore when the sun shines on it a large proportion of the energy is reflected into space. I think scientists have not quite realized how important that is—that 5,000,000 square miles of the earth's surface in the Southern Hemisphere reflect into space a large part of the energy received from the sun. I feel certain that this is one of the chief reasons for the difference in temperature between the Northern and Southern Hemispheres."

AUSTRALIAN RAINFALL.[2]

By H. A. HUNT, Commonwealth Meteorologist.

The main factors to be considered in relation to the controlling causes of rainfall in Australia are the southeast and westerly trade winds, the monsoonal and southern depressions, cyclones from the northeast and northwest Tropics, locally formed cyclones, and the anticyclones, in conjunction with the modifying effects on these various atmospheric movements of the physical features of the different parts of the country.

Around the central dry area of Australia the isohyets describe somewhat concentric curves, the modifications being mostly due to variations in elevation. Thus the Darling Ranges to a great degree account for the rainfall of the southwest corner of the continent. The Flinders

[1] *Reprinted from* Report of the Eighty-fourth Meeting of the British Association for the Advancement of Science. London, 1915, p. 417.

[2] *Reprinted from* Report of the Eighty-fourth Meeting of the British Association for the Advancement of Science, Australia, 1914. London, 1915, p. 439-442.

Range, South Australia, and the Australian Alps, in the southeast, have a heavier rainfall than the surrounding tracts, owing to their cooling effect on the air currents. Along the eastern elevated margin of the Commonwealth the ridges between large river valleys also account for an enhanced precipitation. Examples of the latter type are the Peak Range and the Darling Downs in Queensland, where the eastern ranges of the northern parts of that State obstruct the southeast trade winds and cause our heaviest rainfall. In western Tasmania there is an excessive rainfall for similar reasons, though there the westerly trades are the moisture-laden winds.

During the hotter months, November to April inclusive, the northern parts of Australia are wet and the southern dry; in the colder months, May to October inclusive, the southern parts are wet and the northern dry; while over the eastern areas of the continent the rainfall is distributed fairly generally throughout the year.

The southern portions of the continent, where the precipitations are controlled by the "stormy westerlies," southern cyclones, and V-shaped depressions, enjoy very consistent annual totals, but north of the Tropics and in fact in all parts of the continent subject to monsoon rains the departures from the normal are occasionally very great.

When the monsoonal disturbances are in evidence the effect of the rainfall on the country generally and the economic results for the succeeding season are very pronounced. The interior of the continent becomes transformed. The plains, which ordinarily have an intensifying effect on the heat winds of the summer, are deluged with rain and respond immediately with a luxurious growth of grass and herbage. The air is then both tempered in heat and loses its dryness for considerable periods.

The monsoon region comprises the whole of Australia north of the Tropic of Capricorn, together with southern Queensland and the north of New South Wales. The heaviest rains are in January and February. They are directly due to the indraft caused by the heating of the center of the continent. This leads to the formation of a low pressure in northern Australia and the ascending winds are cooled and deposit their water vapor in heavy rainstorms and thundershowers.

Tropical depressions when well developed are productive of good inland rains, and are evidently caused by southward flows of the atmosphere of wide extent and considerable depth. The "Antarctic" disturbances are, however, the more frequent in winter. The heaviest totals from this last-named source are precipitated on the west coast of Tasmania. Thus at Mount Lyell the total for one year exceeded 140 inches, and even the average is 116.05 inches. When an "Antarctic" is supplemented by a "trough" extending well into the northern interior, it brings much rain to the inland areas of South Australia, Victoria, New South Wales, and even Queensland.

Anticyclonic rains occur at all times of the year, but more markedly from March to September. They benefit particularly the southern area of the continent, and are responsible for many of the heaviest rainfalls and floods on the coastal districts of New South Wales.

Flood rains occur at infrequent intervals over various portions of the Commonwealth, principally in Queensland, the southeastern parts of the continent, and the northern regions of West Australia. Typical instances of floods in southeastern Australia are (1) the flood of January, 1910, in the Upper Darling tributaries, consequent on abnormally heavy rains on the northwestern plains and slopes of New South Wales as well as on the Darling Downs of Queensland. These exceptionally heavy continuous rains were caused by the joint action of an anticyclonic area over the southern and a monsoonal depression operating in the northern half of the continent. A monsoonal tongue developed and extended southward over Queensland and New South Wales, while at the same time the energy of the high pressure in the south increased. In five days large areas in the two States had from 5 to 19 inches of rain. The enormous amount of water that fell over approximately 86,000 square miles of country may be roughly estimated at 31,687,000,000 tons, or 7,100,000,000,000 gallons. (2) A similar development occurred in March of the present year [1914], when a monsoonal tongue extending southward across the continent against an intensified anticyclone in the south was accompanied by severe thunderstorms and torrential rains. Some of the heaviest individual falls were in New South Wales, e. g.:

	Inches.
Taralga, on the central table-land	10.74
Sydney	8.49
Parramatta	16.91
Beecraft, in the metropolitan area	18.84
Wollongong, south coast	25.34

The barometer readings at Sydney ranged from 30.13 to 29.97 inches during the five days the storms were in progress, while the anticyclone to the south gradually gave way simultaneously, the center (30.4 inches) moving slowly over the southern parts of Victoria and Tasmania eastward to the South Pacific Ocean.

The wettest known place in Australia is Innisfail, on the northeast coast of Queensland, where the average rainfall for 21 years is no less than 145 inches, the maximum yearly total being 211.24 inches and the minimum 69.87 inches.

The driest region so far furnished with raingages lies east and northeast of Lake Eyre (South Australia), where less than 5 inches is the average annual rainfall, and where a total of 10 inches is rarely recorded during the 12 months. This minimum rainfall is coincident with the lowest elevation, Lake Eyre being actually below sea level 39 feet.

The inland districts of western Australia have, until recent years, been regarded as the driest part of the Commonwealth; but authentic observations taken during the past decade at settled districts in the east of that State show that the annual average is 10 to 12 inches.

In comparing the rainfall of the chief cities of the rest of the world [42 enumerated] with those of Australia, it is found that Bombay, Calcutta, Colombo, Singapore, and Hongkong are the only cities whose rainfall exceeds that of Sydney. Perth has a greater annual rainfall than New York, and more than that of the 42 cities used in the comparison. Hobart nearly equals London, which Melbourne exceeds by an inch, while 11 of the 42 places considered have less rain than Hobart.

The distribution of average annual rainfall over the Commonwealth and the United Kingdom is as follows:

Rainfall is—	Australia.	British Isles.
	Sq. miles.	*Sq. miles.*
Under 10 inches, upon	1,045,000	Nil.
10 to 15 inches, upon	652,000	Nil.
15 to 20 inches, upon	416,000	Nil.
20 to 30 inches, upon	503,000	24,000
30 to 40 inches, upon	199,000	42,000
Over 40 inches, upon	160,000	55,000

The average area under wheat in the United Kingdom during the years 1910, 1911, and 1912, was 1,926,040 acres, and the average yield was 59,436,392 bushels; while in the Commonwealth for the same period the area under wheat was 7,379,980 acres and the average yield 86,243,133 bushels, a difference in the total yield in favor of Australia of 26,806,741 bushels. In Australia wheat growing, under ordinary conditions, is generally considered a safe and payable proposition when 10 inches of rain and over falls from the month of April to that of October, inclusive. There are in all 484,330 square miles of country with 10 inches of rainfall and over during the wheat-growing period. The output of wheat has been steadily increasing from year to year, and there are vast possibilities of future development in this direction.

The climatic history and prosperity of the last 10 years or so contradict emphatically the preconceived notion that Australia is the particular drought-stricken and precarious area of the earth's surface. These misconceptions of the true character of the country have been held in the developmental stages, to a greater or less extent, in the early histories in the majority of all lands and in the colonization of newly discovered territories; e. g., see history of colonization of United States of America and early Egyptian history. The truth of the matter about Australia's rainfall is that—

(1) It is generally ample for pastoral and agricultural industries over two-thirds of its area.

(2) That different regions have distinct wet and dry periods; these must be fully recognized and industrial operations adapted accordingly.

(3) It is subject in part, but never in the whole, to prolonged periods when the rainfall is short of the seasonal average. Australia is not peculiar in this respect.

It follows, therefore, that, as the so far undeveloped country becomes populated and put to profitable use, the general wealth of the community as a whole will steadily increase.

A model representing the relative rainfall over Australia has been constructed at the Commonwealth Weather Bureau, on a horizontal scale of 133 miles to 1 inch and a vertical scale of 10 inches to 1 centimeter. This model shows at a glance how the annual rainfall is distributed, from the small precipitation over the far interior to the fringe of high rainfall around the greater portion of the coast line, culminating on the eastern side in a great "peak" indicating the annual precipitation over the Harvey Creek and Innisfail district resulting from the prevailing southeast trade winds carrying the moisture against the mountain ranges just inside the coast.

The fringe of relatively high rainfall along the eastern and southeastern coasts of the continent as the result of the elevated contours near the coast in those regions is also striking. The effect of the monsoonal rains over northern Australia is very apparent from the model, which shows the gradual increase of rainfall from less than 10 inches in the interior to over 60 inches on the north coast.

The manner in which the prevailing westerly trade winds carry moisture along the southerly portion of the Commonwealth is clearly marked by the elevations indicating the good rains received over the southwest corner of Australia, and further eastward how the ranges east of Adelaide cause good rainfall there and prevent the rain from that direction reaching the inland parts of Victoria.

In Tasmania, also, is seen the effect of the frequency of the moist westerly winds, causing high rainfall along the mountain ranges of the west coast, with resulting comparative dryness in the eastern parts of that State.

It may be of interest to note in closing that there exists apparently an oscillatory movement of the seasonal rains throughout Australia, about a center in the vicinity of Forbes, New South Wales. It is perhaps a natural coincidence that this apparent center of oscillation is approximately the center of gravity of the Commonwealth's population and is not far from the Federal capital site.

This peculiar oscillatory character of the monthly march of rainfall suggested the construction of a "rain clock." In the center of a piece of cardboard a map of Australia is cut out with a die. At the back of this another piece of cardboard representing the rain area is manipulated on a swivel. By moving the second piece of cardboard backward and forward with an amplitude of oscillation of one-fifth of a circle (72° arc) the land area of the continent affected by dry or wet conditions at any time of year is approximately indicated.

The immediate lessons to be learned from a study of this "clock" are that the seasonal rains are more regular than was generally believed, and that the alternating dry and wet seasons are definitely defined. That being so, when, in obedience to physical law, there is an absence of rain during the normally dry period in any part of Australia, such dryness should not be regarded as drought and an evil, but rather as nature's wise provision for resting the soil.

INFLUENCE OF WEATHER CONDITIONS ON THE AMOUNTS OF NITRIC ACID AND OF NITROUS ACID IN THE RAINFALL NEAR MELBOURNE, AUSTRALIA.[1]

By V. G. ANDERSON.

Daily determinations of the amounts of nitric and of nitrous acid in the rainfall at Canterbury, near Melbourne, have been made since November 1, 1912. The results to February 28, 1914, when correlated with meteorological data for Melbourne and daily isobaric charts of Australia, reveal the existence of a relation between weather conditions and the amounts of nitrogen acids in rain water.

The concentration of nitric acid reached a maximum in summer, a minimum in winter, and an intermediate position during autumn and spring.

The concentration of nitrous acid reached a maximum in winter and a minimum in summer. The ratio of nitric nitrogen to nitreous nitrogen was highest in summer and lowest in winter. On many occasions during winter the ratio was approximately 1:1. A relation between atmospheric temperature and this ratio was noted. Its nature was shown by plotting the mean minimum temperature each month with the mean monthly ratios, the curve being of the same type as those which express changes of chemical velocity with temperature. The ratio is doubled for equal increments of temperature. From the results it would appear that in rain water nitric and nitrous acids are formed in equal molecular proportions and that, if the ratio could be determined instantly or before any change could ensue, it would invariably be 1:1. In cold weather the velocity is retarded to such an extent that little change occurs even after comparatively long periods; hence the increased amounts of nitrous acid found in winter. In hot weather the velocity being greatly increased, the residual amounts of nitrous acid are very small, nearly all having been converted into nitric acid.

The facts point to atmospheric nitrogen peroxide as the source of nitric and nitrous acids in rain water, as

[1] *Reprinted from* Report of the Eighty-fourth Meeting, B. A. A. S., Australia, 1914. London, 1915, pp. 338-339.

this gas reacts with water, forming these acids in equal molecular proportions.

In a graph platted with daily concentrations of total nitrogen (nitric-nitrous) as abscissæ and with rainfall as ordinates, the points are found to arrange themselves into a series of rectangular hyperbolæ. Further, each group of points lying along a particular curve is found to correspond with falls of rain occurring during one particular type of weather. From this it follows that for a particular type of weather (1) the concentration of oxidized nitrogen varies inversely as the rainfall; (2) the product of the concentration and the rainfall is constant; (3) the total weight per unit area of oxidized nitrogen precipitated with rain falling during 24 hours is constant. In brief, the amount of oxidized nitrogen per acre carried down by rain falling on any day is a function of the type of weather and, within certain limits, is independent of the amount of rainfall. These facts may be explained by assuming that for each type of weather there exists in the air a definite concentration of nitrogen peroxide, and that this soluble gas is completely washed out of the air by the first portions of a shower; any further rain falling through the now purified air not increasing the amount of oxidized nitrogen in the rain water but decreasing, by dilution, the concentration.

Nine well-defined recurring types of [Australian] weather have been investigated. These may be classified into three groups as follows: (1) Antarctic types; (2) tropical types; (3) divided-control types (Antarctic and tropical). Table 1 presents the number of cases of each type investigated together with the oxidized nitrogen constant for each type.

TABLE 1.—*The oxidized nitrogen constant in rain accompanying different types of weather at Melbourne, Victoria, 1912–1914.*

Weather types.	Number.	Oxidized nitrogen constant.
		Lbs. per 1,000 acres.
Antarctic types:		
A-shaped Antarctic depressions—		
(*a*) Rear	35	1.5
(*b*) Crest	28	2.5
(*c*) Front	10	4.1
Tropical types:		
Tropical (or monsoonal) depressions—		
(*g*) Spring and autumn	6	16.0
(*h*) Summer type	3	24.0
(*i*) "Heat-wave" type	2	35.0
Divided control types:		
(*d*) Antarctic depressions with *slight* tropical influence	6	6.1
(*e*) Antarctic depressions with *strong* tropical influence	4	8.5
(*f*) Tropical depressions with *slight* Antarctic influence	5	12.0

SERIAL NUMBERS OF WEATHER BUREAU PUBLICATIONS.

By ROBERT SEYBOTH, In Charge of Printing Division.

[Dated: U. S. Weather Bureau, Washington, August, 1915.]

Beginning with January, 1895, a serial number (e. g., W. B. 525) has been given to every Weather Bureau publication that has a full title page or cover.[1] This series includes all folio, quarto, and octavo bulletins, Instrument Division circulars, important miscellaneous publications and extracts from the MONTHLY WEATHER REVIEW, and the successive numbers of the MONTHLY WEATHER REVIEW. As it was found that 59 publications had been issued prior to 1895, counting from the date on which the Weather Bureau was organized by the transfer of the meteorological duties of the Signal Service of the Army to the Department of Agriculture, July 1, 1891, the first publication of 1895 was given the serial number 60. The 59 numbers above referred to do not include the numerous publications issued by the bureau (Signal Service) prior to its transfer from the War Department to the Department of Agriculture.

Most of the numbers from 60 to 210, inclusive, as well as some later ones, are no longer available for distribution.

The reader is particularly urged to note carefully that the symbol "W. B. No. 545" refers to the *serial number* in the following list; it does *not* mean "Weather Bureau Bulletin No. 545," and should not be referred to as such.

[1] See MONTHLY WEATHER REVIEW, November, 1902, 30: 528–530.

W. B. No.	Title of publication.
60	Monthly Weather Review for January, 1895.
61	Instructions to Observers, and Code for Enciphering Reports at Cotton Region and Sugar and Rice Stations of the Weather Bureau.
62	Monthly Weather Review. Annual Summary for 1894.
63	Studies of Weather Types and Storms. No. 1. Types of Storms in January. Extract from Monthly Weather Review.
64	Monthly Weather Review for February, 1895.
65	Monthly Weather Review for March, 1895.
66	Circular B. Instructions for Use of Maximum and Minimum Thermometers. C. F. Marvin. Revised edition.
67	Circular C. Instructions for Use of the Rain Gauge. C. F. Marvin. Revised edition.
68	Monthly Weather Review for April, 1895.
69	Climate and Health. No. 1.
70	Monthly Weather Review for May, 1895.
71	Climate and Health. No. 2.
72	Monthly Weather Review for June, 1895.
73	Climate and Health. No. 3.
74	Monthly Weather Review for July, 1895.
75	Climate and Health. No. 4.
76	Monthly Weather Review for August, 1895.
77	Bulletin No. 16. The Determination of the Relative Quantities of Aqueous Vapor in the Atmosphere by means of the Absorption Lines of the Spectrum. L. E. Jewell.
78	Climate and Health. No. 5.
79	Monthly Weather Review for September, 1895.
80	Instructions to Wind-Signal (Storm-Warning) Displaymen of the Weather Bureau.
81	Statistics of the State Weather Services. O. L. Fassig. *Extract from* Monthly Weather Review.
82	Climate and Health. No. 6.
83	Monthly Weather Review for October, 1895.
84	Climate and Health, Vol. 2, No. 1.
85	Departures from Normal Temperatures and Rainfall, with Crop Yields in Nebraska. H. H. C. Dunwoody.
86	Injury from Frost and Methods of Protection. H. E. Williams.
87	Display of Wind Signals on the Great Lakes.
88	Bulletin No. 17. The Work of the Weather Bureau in Connection with the Rivers of the United States. Willis L. Moore.
89	Monthly Weather Review for November, 1895.
90	Bulletin No. 18. Report of the Fourth Annual Meeting of the American Association of State Weather Services, held at Indianapolis, Indiana, October 16 and 17, 1895. James Berry.
91	Monthly Weather Review for December, 1895.
92	Studies of Weather Types and Storms. Part 2. E. B. Garriott and others. *Extract from* Monthly Weather Review.
93	Climate and Health. Vol. 2, No. 2.
94	Monthly Weather Review. Annual Summary for 1895.
95	Monthly Weather Review for January, 1896.
96	Climate and Health. Vol. 2, No. 3.
97	Bulletin No. 19. Report on the Relative Humidity of Southern New England and other Localities. A. J. Henry.
98	Monthly Weather Review for February, 1896.
99	Monthly Weather Review for March, 1896.
100	Bulletin No. 13. Temperatures Injurious to Food Products in Storage and During Transportation, and Methods of Protection from the Same. H. E. Williams. Reprinted as Farmers' Bulletin No. 125.
101	Monthly Weather Review for April, 1896.
102	St. Louis Tornado. H. C. Frankenfield and A. J. Henry. *Extract from* Monthly Weather Review.
103	Monthly Weather Review for May, 1896.
104	Responses to the Programme of Questions Proposed for Discussion at the International Meteorological Conference to be held in Paris September, 1896.
105	Monthly Weather Review for June, 1896.
106	Monthly Weather Review for July, 1896.

W. B. No. Title of publication.

107 Monthly Weather Review for August, 1896.
108 Monthly Weather Review for September, 1896.
109 Circular G, Instrument Division. Instructions for the Care and Management of Sunshine Recorders. C. F. Marvin.
110 Kite Experiments at the Weather Bureau. C. F. Marvin. *Extract from* Monthly Weather Review.
111 Monthly Weather Review for October, 1896.
112 Daily River Stages. Part V. For the years 1893, 1894, and 1895.
113 Monthly Weather Review for November, 1896.
114 Bulletin No. 20. Storms, Storm Tracks, and Weather Forecasting. F. H. Bigelow.
115 Monthly Weather Review for December, 1896.
116 Monthly Weather Review. Annual Summary for 1896.
117 Monthly Weather Review for January, 1897.
118 Monthly Weather Review for February, 1897.
119 Instructions to Voluntary Observers, 1897.
120 Monthly Weather Review for March, 1897.
121 Monthly Weather Review for April, 1897.
122 A Monograph on the Mechanics and Equilibrium of Kites. C. F. Marvin. *Extract from* Monthly Weather Review.
123 Monthly Weather Review for May, 1897.
124 The Standard System of Coordinate Axes for Magnetic and Meteorological Observations and Computations. F. H. Bigelow. *Extract from* Monthly Weather Review.
125 Wind Barometer Tables. *Extract from* Monthly Weather Review.
126 Clothing and Temperature. W. F. R. Phillips. *Extract from* Monthly Weather Review.
127 Tables for Obtaining the Temperature of the Dewpoint, Relative Humidity, etc.
128 Monthly Weather Review for June, 1897.
129 Monthly Weather Review for July, 1897.
130 The Equations of Hydrodynamics in a Form Suitable for Application to the Earth's Atmosphere. J. Cottier. *Extract from* Monthly Weather Review.
131 Monthly Weather Review for August, 1897.
132 Instructions for use of Aneroid Barographs on the Great Lakes.
133 Instructions Governing the Corn, Wheat, Cotton, Sugar, and Rice Region Service.
134 Instructions to Operators on the United States Seacoast Telegraph Lines.
135 Monthly Weather Review for September, 1897.
136 Bulletin D. Rainfall of the United States, with Annual, Seasonal, and Other Charts. A. J. Henry.
137 Monthly Report of the River and Flood Service for September, 1897.
138 United States Daily Atmospheric Survey. Willis L. Moore.
139 Report of the Chief of the Weather Bureau for 1897. 8vo edition.
140 Forest and Rainfall. H. A. Hazen.
141 Monthly Weather Review for October, 1897.
142 The Probable State of the Sky Along the Path of the Total Eclipse of the Sun, May 28, 1900. F. H. Bigelow. *Extract from* Monthly Weather Review, 1897.
143 Bulletin E. Floods of the Mississippi River. Park Morrill.
144 Monthly Report of the River and Flood Service for October, 1897.
145 The Highest Kite Ascensions at Blue Hill. S. P. Ferguson. *Extract from* Monthly Weather Review, 1897.
146 Monthly Weather Review for November, 1897.
147 Monthly Report of the River and Flood Service for November, 1897. *Extract from* Monthly Weather Review.
148 An Improved Sunshine Recorder. D. T. Maring. *Extract from* Monthly Weather Review.
149 A Winter Barograph Curve from the South Pacific Ocean. *Extract from* Monthy Weather Review.
150 Bulletin No. 21. Abstract of a Report on Solar and Terrestrial Magnetism in Their Relations to Meteorology.
151 Monthly Report of the River and Flood Service for December, 1897. *Extract from* Monthly Weather Review.
152 Monthly Weather Review for December, 1897.
153 Monthly Report of the River and Flood Service for January, 1898. *Extract from* Monthly Weather Review.
154 Monthly Weather Review. Annual Summary for 1897.
155 Monthly Weather Review for January, 1898.
156 Monthly Report of the River and Flood Service for February, 1898. *Extract from* Monthly Weather Review.
157 Monthly Weather Review for February, 1898.
158 Monthly Bulletin of the River and Flood Service for March, 1898. *Extract from* Monthly Weather Review.
159 Wrecks and Casualties on the Great Lakes during 1895, 1896, and 1897.
160 Monthly Bulletin of the River and Flood Service, for April, 1898. *Extract from* Monthly Weather Review.
161 Monthly Weather Review for March, 1898.
162 Normal Annual Sunshine and Snowfall. *Extract from* Monthly Weather Review.

W. B. No. Title of publication.

163 Bulletin No. 22. Climate of Cuba; also, A Note on the Weather of Manila. W. F. R. Phillips.
164 Monthly Bulletin of the River and Flood Service for May, 1898. *Extract from* Monthly Weather Review.
165 Monthly Weather Review for April, 1898.
166 Circular K, Instrument Division. Instructions for Aerial Observers. C. F. Marvin.
167 Circular A, Instrument Division. Instructions for Obtaining and Tabulating Records from Recording Instruments. C. F. Marvin.
168 Investigation of the Cyclonic Circulation and the Translatory Movement of West Indian Hurricanes. Rev. B. Vines. *Extract from* Bulletin No. 11.
169 Bulletin of the River and Flood Service for June, 1898. *Extract from* Monthly Weather Review.
170 Monthly Weather Review for May, 1898.
171 Moisture Tables. C. F. Marvin. *Extract from* Monthly Weather Review.
172 Monthly Weather Review for June, 1898.
173 Monthly Bulletin of the River and Flood Service for July, 1898. *Extract from* Monthly Weather Review.
174 Monthly Weather Review for July, 1898.
175 Monthly Bulletin of the River and Flood Service for August, 1898. *Extract from* Monthly Weather Review.
176 Monthly Weather Review for August, 1898.
177 Monthly Bulletin of the River and Flood Service for September, 1898. *Extract from* Monthly Weather Review.
178 Monthly Weather Review for September, 1898.
179 The Probable State of the Sky Along the Path of Total Eclipse of the Sun, May 28, 1900. *Extract from* Monthly Weather Review.
180 Aneroid Barometers. C. F. Marvin. *Extract from* Monthly Weather Review.
181 Report of the Chief of the Weather Bureau for 1898. 8vo.
182 Monthly Bulletin of the River and Flood Service for October, 1898. *Extract from* Monthly Weather Review.
183 Monthly Weather Review for October, 1898.
184 Instructions for Voluntary Observers. 1899.
185 Monthly Weather Review for November, 1898.
186 Bulletin No. 23. Frost. When to Expect it and How to Lessen the Injury Therefrom. W. H. Hammon.
187 Bulletin No. 24. Proceedings of the Convention of Weather Bureau Officials held at Omaha, Nebr., October 13–14, 1898. James Berry.
188 Climate and Crop Report. Season of 1898. Alaska Section. H. L. Ball. *Extract from* Monthly Weather Review.
189 Monthly Weather Review for December, 1898.
190 Monthly Weather Review. Annual Summary for 1898.
191 Bulletin No. 25. Weather Forecasting. Some Facts Historical, Practical, and Theoretical. Willis L. Moore.
192 Monthly Weather Review for January, 1899.
193 Circular E, Instrument Division. Measurement of Precipitation. C. F. Marvin.
194 Hydrology of the Lake Minnetonka Watershed. Geo. W. Cooley. *Extract from* Monthly Weather Review.
195 Monthly Weather Review for February, 1899.
196 Monthly Weather Review for March, 1899.
197 Bulletin No. 26. Lightning and the Electricity of the Air. A. G. McAdie and A. J. Henry. In two parts.
198 Monthly Weather Review for April, 1899.
199 Property Loss by Lightning in 1898. A. J. Henry and A. G. McAdie.
200 Monthly Weather Review for May, 1899.
201 Climatology of the Isthmus of Panama. H. L. Abbot. *Extract from* the Monthly Weather Review.
202 An Advance in Measuring and Photographing Sounds. B. F. Sharp. *Extract from* Monthly Weather Review.
203 Variations in Lake Levels and Atmospheric Pressure. *Extract from* Monthly Weather Review.
204 Monthly Weather Review for June, 1899.
205 Monthly Weather Review for July, 1899.
206 Report of the Chief of the Weather Bureau for 1899. 8vo.
207 Monthly Weather Review for August, 1899.
208 Bulletin F. Vertical Gradients of Temperature, Humidity, and Wind Direction. (Kite Observations of 1898.) H. C. Frankenfield.
209 Bulletin No. 27. The Probable State of the Sky Along the Path of Total Eclipse of the Sun, May 28, 1900. Observations of 1899. F. H. Bigelow.
210 Monthly Weather Review for September, 1899.
211 Bulletin No. 28. The Climate of San Francisco, Cal. A. G. McAdie and Geo. H. Willson.
212 Monthly Weather Review for October, 1899.
213 Meteorological Chart of the Great Lakes. Summary for the Season of 1899.

W. B. No. Title of publication.

214 Monthly Weather Review for November, 1899.
215 Monthly Weather Review for December, 1899.
216 Monthly Weather Review. Annual Summary for 1899.
217 Monthly Weather Review for January, 1900.
218 Monthly Weather Review for February, 1900.
219 Bulletin No. 29. Frost Fighting. A. G. McAdie.
220 Monthly Weather Review for March, 1900.
221 Bulletin G. Atmospheric Radiation. F. W. Very.
222 Monthly Weather Review for April, 1900.
223 Anemometer Tests. C. F. Marvin. *Extract from* Monthly Weather Review.
224 Monthly Weather Review for May, 1900.
225 Monthly Weather Review for June, 1900.
226 Monthly Weather Review for July, 1900.
227 Daily River Stages. Part VI. For 1896, 1897, 1898, and 1899.
228 Tables of Daily Precipitation. H. C. Frankenfield.
229 Monthly Weather Review for August, 1900.
230 Monthly Weather Review for September, 1900.
231 Report of the Chief of the Weather Bureau for 1900. 8vo.
232 Bulletin H. West India Hurricanes. E. B. Garriott.
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234 Monthly Weather Review for October, 1900.
235 Psychrometric Tables. C. F. Marvin.
236 Monthly Weather Review for November, 1900.
237 Meteorological Chart of the Great Lakes. Summary for the Season of 1900.
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244 Meteorological Chart of the Great Lakes. No. 1. 1901.
245 Monthly Weather Review for April, 1901.
246 Monthly Weather Review for May, 1901.
247 Monthly Weather Review for June, 1901.
248 Weather Bureau Exhibit at the Pan-American Exposition. Buffalo, N. Y., 1901. *Reprint from* Monthly Weather Review.
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254 The Solar Constant. F. W. Very. *Reprint from* Monthly Weather Review.
255 Monthly Weather Review for October, 1901.
256 Bulletin No. 30. Loss of Life in the United States by Lightning. A. J. Henry.
257 Monthly Weather Review for November, 1901.
258 Meteorological Chart of the Great Lakes. No. 2. 1901.
259 Monthly Weather Review for December, 1901.
260 Monthly Weather Review. Annual Summary for 1901.
261 Monthly Weather Review for January, 1902.
262 Bulletin J. Wind Velocity and Fluctuation of Water Level on Lake Erie. A. J. Henry.
263 Monthly Weather Review for February, 1902.
264 Meteorological Chart of the Great Lakes. No. 1. 1902.
265 Bulletin No. 31. Proceedings of the Second Convention of Weather Bureau Officials, held at Milwaukee, August 27–29, 1901.
266 Monthly Weather Review for March, 1902.
267 Bulletin I. Eclipse Meteorology and Allied Problems.
268 Bulletin No. 32. Hurricanes: Especially Those of Porto Rico and St. Kitts. W. H. Alexander.
269 Monthly Weather Review for April, 1902.
270 Monthly Weather Review for May, 1902.
271 Monthly Weather Review for June, 1902.
272 Monthly Weather Review for July, 1902.
273 Studies on the Statics and Kinematics of the Atmosphere in the United States. F. H. Bigelow. *Reprint from* Monthly Weather Review.
274 Monthly Weather Review for August, 1902.
275 Monthly Weather Review for September, 1902.
276 Monthly Weather Review for October, 1902.
277 Circular A, Instrument Division. Instructions for Obtaining and Tabulating Records from Recording Instruments. C. F. Marvin. Second edition.
278 Monthly Weather Review for November, 1902.
279 Monthly Weather Review for December, 1902. Vol. XXX, No. 12.
280 Meteorological Charts of the Great Lakes, 1902.
281 Monthly Weather Review. Annual Summary for 1902.
282 Monthly Weather Review for January, 1903.
283 Monthly Weather Review for February, 1903.
284 Monthly Weather Review for March, 1903.
285 Circular E, Instrument Division. Measurement of Precipitation. C. F. Marvin. Second edition.
286 Meteorological Chart of the Great Lakes, 1903.
287 Monthly Weather Review for April, 1903.
288 Bulletin K. Storms of the Great Lakes, E. B. Garriott.
289 Monthly Weather Review for May, 1903.
290 Studies on the Meteorological Effects of the Solar and Terrestrial Physical Processes. The Semidiurnal Periods in the Earth's Atmosphere. F. H. Bigelow. *Extract from* Monthly Weather Review.
291 Monthly Weather Review for June, 1903.
292 Bulletin L. Climatology of California. Alexander G. McAdie.
293 Monthly Weather Review for July, 1903.
294 Bulletin No. 33. Weather Folk-Lore and Local Weather Signs. E. B. Garriott.
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296 Monthly Weather Review for September, 1903.
297 Monthly Weather Review for October, 1903.
298 Meteorological Chart of the Great Lakes. Summary for 1903.
299 Monthly Weather Review for November, 1903.
300 Monthly Weather Review for December, 1903.
301 Climatic Charts of the United States.
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307 Monthly Weather Review for March, 1904.
308 Monthly Weather Review for April, 1904.
309 Meteorological Chart of the Great Lakes, 1904.
310 Monthly Weather Review for May, 1904.
311 Bulletin No. 34. Climate: Its Physical Basis and Controlling Factors. Willis L. Moore.
312 Invariability of our Winter Climate. William B. Stockman. *Reprint from* Monthly Weather Review.
313 Monthly Weather Review for June, 1904.
314 On the General Circulation of the Atmosphere in Middle and Higher Latitudes. W. N. Shaw. *Reprint from* Monthly Weather Review.
315 Monthly Weather Review for July, 1904.
316 Studies on the Circulation of the Atmosphere of the Sun and of the Earth. F. H. Bigelow. *Reprint from* Monthly Weather Review.
317 Monthly Weather Review for August, 1904.
318 Monthly Weather Review for September, 1904.
319 Monthly Weather Review for October, 1904.
320 Sunshine Tables; three parts.
321 Monthly Weather Review for November, 1904.
322 Bulletin No. 35. Long-Range Weather Forecasts. E. B. Garriott.
323 Monthly Weather Review for December, 1904.
324 Meteorological Chart of the Great Lakes. No. 2. 1904.
325 Monthly Weather Review. Annual Summary for 1904.
326 Bulletin N. Periodic Variation of Rainfall in the Arid Region. William B. Stockman.
327 Evaporation Observations in the United States. H. H. Kimball. *Reprint from* Monthly Weather Review.
328 Monthly Weather Review for January, 1905.
329 Monthly Weather Review for February, 1905.
330 Monthly Weather Review for March, 1905.
331 Monthly Weather Review for April, 1905.
332 Monthly Weather Review for May, 1905.
333 Meteorological Chart of the Great Lakes, 1905.
334 Bulletin O. Temperature and Relative Humidity Data. William B. Stockman.
335 Monthly Weather Review for June, 1905.
336 Improved Methods for Finding Altitude and Azimuth, Geographical Position, and the Variation of the Compass. G. W. Littlehale. *Reprint from* Monthly Weather Review.
337 Monthly Weather Review for July, 1905.
338 Report of the Chief of the Weather Bureau for 1905.
339 Daily River Stages. Part VII. For the Years 1900, 1901, 1902, 1903, and 1904.
340 Monthly Weather Review for August, 1905.
341 Monthly Weather Review for September, 1905.
342 Bulletin No. 36. Relations between Climates and Crops. Cleveland Abbe.
343 Monthly Weather Review for October, 1905.
344 Studies on the Diurnal Periods in the Lower Strata of the Atmosphere. F. H. Bigelow.
345 Monthly Weather Review for November, 1905.

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346	Monthly Weather Review for December, 1905.
347	Circulars B and C (combined), Instrument Division, Instructions for Cooperative Observers. C. F. Marvin. Third edition.
348	Monthly Weather Review. Annual Summary for 1905.
349	Bulletin No. 37. Recent Practice in the Erection of Lightning Conductors. Alfred J. Henry.
350	Meteorological Chart of the Great Lakes, 1905. No. 2.
351	Monthly Weather Review for January, 1906.
352	Monthly Weather Review for February, 1906.
353	Monthly Weather Review for March, 1906.
354	Monthly Weather Review for April, 1906.
355	Bulletin P. Cold Waves and Frost in the United States. E. B. Garriott.
356	Meteorological Chart of the Great Lakes, 1906.
357	Monthly Weather Review for May, 1906.
358	Monthly Weather Review for June, 1906.
359	Monthly Weather Review for July, 1906.
360	Monthly Weather Review for August, 1906.
361	Bulletin Q. Climatology of the United States. Alfred J. Henry.
362	Monthly Weather Review for September, 1906.
363	Monthly Weather Review for October, 1906.
364	Circular D, Instrument Division. Anemometry. C. F. Marvin. Third edition.
365	Monthly Weather Review for November, 1906.
366	Monthly Weather Review for December, 1906.
367	Monthly Weather Review. Annual Summary for 1906.
368	Monthly Weather Review for January, 1907.
369	Monthly Weather Review for February, 1907.
370	Monthly Weather Review for March, 1907.
371	Monthly Weather Review for April, 1907.
372	Studies on the Thermodynamics of the Atmosphere. F. H. Bigelow. *Reprint from* Monthly Weather Review.
373	Monthly Weather Review for May, 1907.
374	Monthly Weather Review for June, 1907.
375	Meteorological Chart of the Great Lakes, 1906. No. 2.
376	Meteorological Chart of the Great Lakes, 1907.
377	Monthly Weather Review for July, 1907.
378	Monthly Weather Review for August, 1907.
379	Report of the Chief of the Weather Bureau, 1906–7.
380	Monthly Weather Review for September, 1907.
381	Bulletin of the Mount Weather Observatory. Vol. 1, Part 1.
382	Monthly Weather Review for October, 1907.
383	Monthly Weather Review for November, 1907.
384	Monthly Weather Review for December, 1907.
385	Monthly Weather Review. Annual Summary for 1907.
386	Monthly Weather Review for January, 1908.
387	Monthly Weather Review for February, 1908.
388	Bulletin of the Mount Weather Observatory. Vol. 1, Part 2.
389	Monthly Weather Review for March, 1908.
390	Monthly Weather Review for April, 1908.
391	Bulletin of the Mount Weather Observatory. Vol. 1, Part 3.
392	Monthly Weather Review for May, 1908.
393	Monthly Weather Review for June, 1908.
394	Monthly Weather Review for July, 1908.
395	Bulletin R. The Daily Normal Temperature and Precipitation of the United States. F. H. Bigelow.
396	Monthly Weather Review for August, 1908.
397	Instructions to the Marine Meteorological Observers of the United States Weather Bureau.
398	Monthly Weather Review for September, 1908.
399	Monthly Weather Review for October, 1908.
400	Bulletin of the Mount Weather Observatory. Vol. 1, Part 4.
401	Circular F, Instrument Division. Barometers and the Measurement of Atmospheric Pressure. C. F. Marvin. Third edition.
402	Monthly Weather Review for November, 1908.
403	Daily River Stages. Part VIII. For the years 1905 and 1906.
404	Monthly Weather Review for December, 1908.
405	Monthly Weather Review. Annual Summary for 1908.
406	Bulletin of the Mount Weather Observatory. Vol. 2, Part 1.
407	Monthly Weather Review for January, 1909.
408	Bulletin S. Report on the Temperatures and Vapor Tensions of the United States. F. H. Bigelow.
409	A Manual for Observers in Climatology and Evaporation.
410	Monthly Weather Review for February, 1909.
411	Monthly Weather Review for March, 1909.
412	Bulletin of the Mount Weather Observatory. Vol. 2, Part 2.
413	Monthly Weather Review for April, 1909.
414	Monthly Weather Review for May, 1909.
415	Instructions to Special River and Rainfall Observers.
416	Monthly Weather Review for June, 1909.
417	Monthly Weather Review for July, 1909.
418	Bulletin of the Mount Weather Observatory. Vol. 2, Part 3.
419	Monthly Weather Review for August, 1909.
420	Monthly Weather Review for September, 1909.
421	Monthly Weather Review for October, 1909.
422	Monthly Weather Review for November, 1909.
423	Studies on the Vortices in the Atmosphere of the Earth. F. H. Bigelow *Reprints from* the Monthly Weather Review.
424	Monthly Weather Review for December, 1909.
425	Monthly Weather Review for January, 1910.
426	Monthly Weather Review for February, 1910.
427	Bulletin of the Mount Weather Observatory. Vol. 2, Part 4.
428	Bulletin of the Mount Weather Observatory. Vol. 2, Part 5.
429	Monthly Weather Review for March, 1910.
430	Bulletin of the Mount Weather Observatory. Vol. 2, Part 6.
431	Monthly Weather Review for April, 1910.
432	Bulletin of the Mount Weather Observatory. Vol. 3, Part 1.
433	Monthly Weather Review for May, 1910.
434	Monthly Weather Review for June, 1910.
435	Bulletin No. 38. Mississippi River Levees and their Effect on River Stages during Flood Periods. S. C. Emery.
436	Monthly Weather Review for July, 1910.
437	Bulletin of the Mount Weather Observatory. Vol. 3, Part 2.
438	Monthly Weather Review for August, 1910.
439	Bulletin of the Mount Weather Observatory. Vol. 3, Part 3.
440	Monthly Weather Review for September, 1910.
441	Bulletin of the Mount Weather Observatory. Vol. 3, Part 4.
442	Monthly Weather Review for October, 1910.
443	Bulletin T. Frost and Temperature Conditions in the Cranberry Marshes of Wisconsin. H. J. Cox.
444	Instructions to Marine Meteorological Observers of the Weather Bureau. Third edition.
445	Circular E, Instrument Division. Measurement of Precipitation. C. F. Marvin. Third edition, and reprint of 1913.
446	Monthly Weather Review for November, 1910.
447	Bulletin U. Temperature Departures, Monthly and Annual, in the United States. 1873 to 1909.
448	Monthly Weather Review for December, 1910.
449	Bulletin V. Frost Data of the United States. P. C. Day.
450	Instructions for Operating the Hygrograph. Appendix to Circular A, Instrument Division. C. F. Marvin.
451	Monthly Weather Review for January, 1911.
452	Monthly Weather Review for February, 1911.
453	Daily River Stages. Part X. For the years 1909 and 1910. (The serial number was inadvertently omitted from Part IX, 1907 and 1908.)
454	Bulletin of the Mount Weather Observatory. Vol. 3, Part 5.
455	Monthly Weather Review for March, 1911.
456	Circular G, Instrument Division. Instructions for the Care and Management of Sunshine Recorders. C. F. Marvin. Third edition.
457	Bulletin of the Mount Weather Observatory. Vol. 3, Title-page and Index.
458	Monthly Weather Review for April, 1911.
459	Circulars B and C (combined). Instrument Division. Instructions for Cooperative Observers. C. F. Marvin. Fourth edition.
459*	Bulletin of the Mount Weather Observatory. Vol. 4, Part 1.
460	Monthly Weather Review for May, 1911.
461	Monthly Weather Review for June, 1911.
462	Bulletin of the Mount Weather Observatory. Vol. 4, Part 2.
463	Bulletin No. 39. A course in Meteorology and Physical Geography. W. N. Allen.
464	Monthly Weather Review for July, 1911.
465	Monthly Weather Review for August, 1911.
466	Bulletin of the Mount Weather Observatory. Vol. 4, Part 3.
467	Bulletin No. 42. Forecasting the Weather. G. S. Bliss.
468	Monthly Weather Review for September, 1911.
469	Instructions to Special River and Rainfall Observers. (Reprint.)
470	Monthly Weather Review for October, 1911.
471	Bulletin No. 40. The Relation between the Precipitation over the Watershed of the Ohio River above and the Stream-flow below at Cincinnati. J. Warren Smith.
472	Circular F, Instrument Division. Barometers and the Measurement of Atmospheric Pressure. C. F. Marvin. Fourth edition.
473	Bulletin No. 41. Forecasting Frost in the North Pacific States. E. A. Beals.
474	Monthly Weather Review for November, 1911.
475	Monthly Weather Review for December, 1911.
476	Bulletin W. Summaries of Climatological Data by Sections. (Also issued in 104 separate parts without W. B. numbers.)
477	Monthly Weather Review for January, 1912.
478	Bulletin of the Mount Weather Observatory. Vol. 4, Part 4.
479	Monthly Weather Review for February, 1912.
480	Bulletin of the Mount Weather Observatory. Vol. 4, Part 5.
481	Monthly Weather Review for March, 1912.
482	Bulletin of the Mount Weather Observatory. Vol. 4, Part 6.
483	Bulletin of the Mount Weather Observatory. Vol. 4, Title page and Index.

* (Serial number erroneously repeated.)

W. B. No.	Title of publication.
484	Monthly Weather Review for April, 1912.
485	Monthly Weather Review for May, 1912.
486	Monthly Weather Review for June, 1912.
487	Bulletin X. Hurricanes of the West Indies. O. L. Fassig.
488	Monthly Weather Review for July, 1912.
489	Bulletin of the Mount Weather Observatory. Vol. 5, Part 1.
490	Monthly Weather Review for August, 1912.
491	Monthly Weather Review for September, 1912.
492	Bulletin of the Mount Weather Observatory. Vol. 5, Part 2.
493	Instructions governing the Corn, Wheat, Cotton, and Sugar and Rice Region Service. Third edition.
494	Bulletin of the Mount Weather Observatory. Vol. 5, Part 3.
495	Monthly Weather Review for October, 1912.
496	Monthly Weather Review for November, 1912.
497	Monthly Weather Review for December, 1912.
498	Bulletin No. 43. The Rivers and Floods of the Sacramento and San Joaquin Watersheds. N. R. Taylor.
499	Bulletin No. 44. The Climate of San Francisco. A. G. McAdie.
500	Monthly Weather Review for January, 1913.
501	Bulletin of the Mount Weather Observatory. Vol. 5, Part 4.
502	Monthly Weather Review for February, 1913.
503	Bulletin of the Mount Weather Observatory. Vol. 5, Part 5.
504	Monthly Weather Review for March, 1913.
505	Bulletin of the Mount Weather Observatory. Vol. 5, Part 6.
506	Monthly Weather Review for April, 1913.
507	Daily River Stages. Part XI. For the years 1911 and 1912.
508	Monthly Weather Review for May, 1913.
509	Circular A, Instrument Division. Instructions for Obtaining and Tabulating Records from Recording Instruments. C. F. Marvin. Third edition.
510	Monthly Weather Review for June, 1913.
511	Bulletin of the Mount Weather Observatory. Vol. 6, Part 1.
512	Brief List of Meteorological Text Books. C. F. Talman. (First edition, 1909; second edition, 1910; third edition, 1913.)
513	Monthly Weather Review for July, 1913.
514	Bulletin of the Mount Weather Observatory. Vol. 5, Title-page and Index.
515	Monthly Weather Review for August, 1913.
516	Monthly Weather Review for September, 1913.
517	Bulletin of the Mount Weather Observatory. Vol. 6, Part 2.
518	Circular G, Instrument Division. Instructions for the Care and Management of Electrical Sunshine Recorders. Fourth edition.
519	Bulletin Y. The Ohio and Mississippi Floods of 1912. H. C. Frankenfield.
520	Bulletin Z. The Floods of 1913 in the Rivers of the Ohio and Lower Mississippi Valleys. A. J. Henry.
521	Monthly Weather Review for October, 1913.
522	The Weather Bureau Kiosk. C. F. Marvin.
523	Monthly Weather Review for November, 1913.
524	Bulletin of the Mount Weather Observatory. Vol. 6, Part 3.
525	Monthly Weather Review for December, 1913.
526	Bulletin of the Mount Weather Observatory. Vol. 6, Part 4.
527	Monthly Weather Review for January, 1914.
528	Monthly Weather Review for February, 1914.
529	Monthly Weather Review for March, 1914.
530	Circular D, Instrument Division. Instructions for the Installation and Maintenance of Wind Measuring and Recording Apparatus. Fourth revision.
531	Monthly Weather Review for April, 1914.
532	Bulletin of the Mount Weather Observatory. Vol. 6, Part 5.
533	Monthly Weather Review for May, 1914.
534	Monthly Weather Review for June, 1914.
535	Monthly Weather Review for July, 1914.
536	Monthly Weather Review for August, 1914.
537	Monthly Weather Review for September, 1914.
538	Monthly Weather Review. Supplement No. 1. Types of Storms of the United States and their Average Movements. E. H. Bowie and R. H. Weightman.
539	Circulars B and C (combined), Instrument Division. Instructions for Cooperative Observers. Fifth edition.
540	Monthly Weather Review for October, 1914.
541	Monthly Weather Review for November, 1914.
542	Papers on Frosts and Frost Protection in the United States. *Reprinted from* Monthly Weather Review, October, 1914.
543	Monthly Weather Review for December, 1914.
544	Climatological Data for the United States by Sections. January, 1915. [See 551.]
545	Monthly Weather Review for January, 1915.
546	Climatological Data for the United States by Sections. February, 1915.
547	Monthly Weather Review for February, 1915.
548	Climatological Data for the United States by Sections. March, 1915.
549	Daily River Stages. Part XII. For the years 1913 and 1914.
550	Monthly Weather Review for March, 1915.
551	Climatological Data for the United States by Sections. For the Year 1914. [See also unnumbered list below.]
552	Climatological Data for the United States by Sections. April, 1915.
553	Monthly Weather Review for April, 1915.
554	Monthly Weather Review for May, 1915.
555	Climatological Data for the United States by Sections. May, 1915.
556	Climatological Data for the United States by Sections. June, 1915.
557	Monthly Weather Review for June, 1915.
558	Monthly Weather Review. Supplement No. 2. Calendar of the common trees of the eastern United States, by G. N. Lamb; Phenological data by T. Mikesell at Wauseon, Ohio.
559	Circular L, Instrument Division. Instructions for the Installation and Operation of Class "A" Evaporation Stations. B. C. Kadel.
560	Monthly Weather Review for July, 1915.

TABLE 1.—*Monthly Weather Review, by years and volumes.*

[Each volume usually consists of 12 monthly numbers. Annual Summaries, when included in a volume, were issued as No. 13 of that volume.]

Year.	Volume.	Year.	Volume.
1873	[1]	1894	22
1874	[2]	1895	23
1875	[3]	1896	24
1876	[4]	1897	25
1877	[5]	1898	26
1878	[6]	1899	27
1879	[7]	1900	28
1880	[8]	1901	29
1881	[9]	1902	30
1882	[10]	1903	31
1883	[11]	1904	32
1884	12	1905	33
1885	13	1906	34
1886	[2] 14	1907	35
1887	15	1908	36
1888	16	1909 [5]	37
1889	[3] 17	1910 [5]	38
1890	18	1911 [5]	39
1891	19	1912 [5]	40
1892	20	1913 [5]	41
1893	[4] 21	1914 [5]	42
		1915 [5]	43

[1] Volume numbers first appeared in the issue for February, 1883.
[2] The first title-page was for v. 14, 1886.
[3] An annual summary and annual index first given for 1889, v. 17.
[4] Annual summary advanced (1893, v. 21) to a separate, thirteenth part of which appeared annually thereafter until 1909.
[5] These years have a title-page and annual index, but no annual summary.

While the above list embraces the vast majority of Weather Bureau publications, there are a few of general interest that have not received these numbers, such as—

Proceedings of the Third Convention of Weather Bureau Officials held at Peoria, Ill., September 20–22, 1904. Washington, 1904. 267 p. 8°.

Climatological data, for each of 46 sections, monthly. 8 p. 4°. [Chiefly published at Section Centers. A separate issue of text and tables appears since January, 1914, in corresponding sections of "Climatological Data for the United States by Sections" as listed under W. B. No. 544 and elsewhere.]

National Weather and Crop Bulletin, monthly or weekly. 8 p. 4°.

Snow and ice bulletin with chart, weekly during the winter. f°.

The Weather Bureau. Washington, 1915. 58 p. 12°.

Explanation of the Weather Map. n. d. 4 p. 8°. Various climatological charts.

NOTES.

It is reported that Dr. Wilhelm Trabert has retired from the chair of Geophysics in the University of Vienna, and also from the directorship of the K. k. Zentralanstalt für Meteorologie und Geodynamik. The cause is reported to be ill health.

Dr. A. de Quervain has been appointed honorary professor of meteorology in the University of Zurich.

Dr. A. J. Herbertson, professor of geography in the University of Oxford, and well known for his contributions to geography and climatology, died July 31, 1915, at the age of 50 years.

SECTION III—FORECASTS.

FORECASTS AND WARNINGS FOR JULY, 1915.

By EDWARD H. BOWIE, District Forecaster.

[Dated: U. S. Weather Bureau, Washington, Aug. 31, 1915.]

Over interior districts pressure was generally low at the beginning of the month, while relatively high pressures obtained in the vicinity of the Bermudas and over the Canadian Northwest. During the two days following pressure continued low over northern districts east of the Rocky Mountains and showers and thunderstorms occurred quite generally over that portion of the country.

A low that was central over northwestern Minnesota on the 3d moved to Lake Superior by the evening of the 4th. It then advanced in a northeasterly direction with increased intensity during the next 12 hours, and during the following two days passed down the St. Lawrence Valley. Quite general precipitation in the form of showers and thunderstorms occurred over the eastern half of the country attending its passage. On the morning of the 4th an advisory message was sent to ports on Lakes Michigan and Huron for fresh shifting winds and squalls, and on the 5th storm warnings were ordered for northern Lake Michigan, northern Huron, eastern Superior, eastern Erie, and Ontario. The advices were fully justified. On the 5th advices were also disseminated for strong winds on the Atlantic coast from Delaware Breakwater northward, and high winds occurred substantially as indicated in the warning.

The high-pressure area that was over Alberta on the 1st passed southeastward with diminished energy to Oklahoma by the 3d, showers and thunderstorms attending the change to lower temperature preceding it.

A high-pressure area closely following, appeared over Alberta on the morning of the 3d and passed southeastward to Oklahoma, and thence eastward with decreasing intensity, causing decidedly cool weather for the season with temperatures equal to or below, the records of low July temperatures at points in the Great Plains States and Mississippi Valley.

Pressure had been relatively low over the middle plateau and, following the passage of the high area just referred to, a low center appeared on the morning of the 5th over Nevada and passed thence eastward to southwestern Pennsylvania by the 8th. Its course then trended to the northward, and on the 9th a storm of marked character was over the eastern Maine coast, with lowest pressure reading 29.16 inches at Eastport. Very little precipitation attended this storm west of the Mississippi River and the precipitation that accompanied it east of the Mississippi was confined to the immediate storm area. On the 8th storm-warning advices were issued to ports on the Middle Atlantic and southern New England coasts for severe squalls and during the following 36 hours, strong winds occurred over the area indicated and over the northern New England coast as well.

After the passage of this low area, pressure rose over the northern Plains States and western Ontario, and on the morning of the 8th a high-pressure area of slight intensity was over western Lake Superior. It passed thence southeastward to the middle Atlantic States by the morning of the 10th.

Pressure diminished over the Rocky Mountain region during the 8th, and on the 9th a trough of low pressure extended from Alberta to Arizona. During the next 24 hours it moved eastward to the Plains States, after which time pressure within the trough rose, the main center being over Wisconsin. This rather indefinite area of low pressure advanced eastward, causing showers and thunderstorms from the Plains States eastward over middle and northern districts.

From the morning of the 11th to the evening of the 12th there were some indications of the eastward advance of a low from the southern Rocky Mountain region. The low did not, however, advance eastward. From the evening of the 12th to the morning of the 14th a low passed from western Utah to South Dakota, causing showers and thunderstorms over the middle Rocky Mountain region and the Plains States. It did not, however, make further progress.

At 8 p. m. of the 14th pressure was generally low over the Rocky Mountain region, and on the morning of the 16th a low center was over Lake Superior, having advanced from the before-mentioned region during the preceding 36 hours. It thence passed eastward to the Canadian Maritime Provinces by the 18th.

At 8 p. m. of the 16th another low area appeared over British Columbia, and during the next 12 hours passed southeastward to Wyoming. It then advanced on an easterly course to New England by the evening of the 19th. Showers occurred over the northern Rocky Mountain region during the night of the 16th and on the 17th, and later over most of the country from the Mississippi Valley eastward, except along the Gulf coast.

Conditions remained unsettled over the Middle and Southern Atlantic Coast States from the 20th to the 23d, inclusive, due to the passage of a disturbance of slight intensity from the mouth of the Mississippi on the night of the 17th to a position off the middle Atlantic coast on the morning of the 21st. There was also another slight disturbance that passed from northwestern Florida to southwestern Florida from the evening of the 21st to the evening of the 24th.

At 8 p. m. of the 17th a high-pressure area was central over Alberta, whence it passed slowly south and southeastward to Kansas by the 22d. Its course then became easterly, and on the 24th it was over the Middle Atlantic States. It caused decidedly cooler weather from the Rocky Mountain region eastward to the Atlantic coast.

Another high-pressure area appeared over eastern Ontario on the morning of the 22d, which moved during the 24 hours following to the Canadian Maritime Provinces, in which vicinity it remained for several periods.

A disturbance of minor character passed from Alberta on the 22d to Iowa by the 24th, and thereafter lost its identity.

By the 23d pressure had risen over the Northwest, and during the following 48 hours further increased, the center of highest pressure on the morning of the 25th being over northern Minnesota. This high area passed slowly across the lake region to western Pennsylvania by the evening of the 27th with decreased energy, and later united with the high-pressure area that prevailed at that time over the Atlantic Ocean.

Pressure decreased during the 26th over the middle plateau, and on the evening of that date a low center was over northern Nevada, whence it passed very slowly southeastward to western Colorado by the end of the month.

At the end of the month pressure was slightly above normal on the north Pacific coast, along the Canadian border, and off the north Atlantic coast, while over interior districts pressure readings were relatively low and weather conditions very unsettled, showers and thunderstorms having occurred during the 24 hours preceding the close of the month over the greater portion of the country east of the Rocky Mountains.

Chicago Forecast District.—No special warnings were issued during the month except frost warnings for portions of Wyoming on the 1st, 10th, 17th, and 19th, and for the Wisconsin cranberry marshes on the 4th, 5th, 19th, 20th, and 25th. Because of the unsettled conditions throughout the Middle West during the month, the forecasting of frost in the cranberry marshes was most difficult, low night temperatures often being prevented by a cloudy sky. On the 4th and 25th, the message to the cranberry marshes stated that frost was indicated if the weather cleared, but the sky remained overcast. The only full verification was attained following the warnings of the 5th.—*H. J. Cox, Professor of Meteorology.*

Denver and New Orleans Forecast Districts.—No warnings were issued during the month.

Portland Forecast District.—Fire-wind forecasts were issued on the 23d and 24th. Following the forecast there were two hot days with northerly winds and a few fires started in the district. On the third day the weather clouded up and the fire hazard lessened materially.

San Francisco Forecast District.—No important warnings were issued during the month.

NORTHERN HEMISPHERE PRESSURE.

Alaska.—Pressure was decidedly above normal over western and northern portions, while along the southern Alaskan coast east of Valdez pressures averaged near but slightly below normal. Pressure was below normal from the 4th to 10th over the northern portion, while on the southern Alaskan coast pressure was low from the 4th to 13th. At other times during the month pressures were generally above the seasonal average.

Honolulu.—Pressure for the month was slightly less than normal. Lows occurred on the 11th–12th, 16th–17th, and 23d–24th, while pressure was above normal from the 3d to 10th and from the 26th to 28th.

Azores.—Pressure was very steady throughout the month and averaged slightly above the normal. The only low of any importance during the month occurred on the 26th.

Bermuda.—Pressure averaged above normal, the only readings below normal during the month occurring from the 14th to 18th. There was a gradual fall from the 4th to about the 16th, and a gradual rise thereafter until the 25th–26th.

United States.—Pressure was generally below the average for the season during the first half and generally above during the second half of the month.

SECTION IV.—RIVERS AND FLOODS.

RIVERS AND FLOODS, JULY, 1915.

By ALFRED J. HENRY, Professor of Meteorology, in Charge of River and Flood Division.

[Dated Washington, D. C., Aug. 28, 1915.]

There were no severe floods in the great rivers of the United States, and none of the spectacular events that are associated with severe floods in large rivers, yet the total flood loss during the month, if it were possible to compute it accurately, would be startling. The great bulk of the loss fell upon agricultural interests.

The precipitation of the month was remarkably heavy within a radius of, say 100 miles from Kansas City, Mo.; also over a comparatively small area in northwestern Ohio and a larger area in New England; stretching thence to the southwest over the headwaters of the North Branch of the Susquehanna. These areas may be considered as so many islands of higher precipitation in a general belt of heavy rainfall that extended from central New England westward, just south of the Lower Lakes, and over northern Ohio, northern Illinois, northern Missouri, to the region of maximum precipitation for the month. See Chart No. V, this REVIEW. This distribution of precipitation did not parallel any of the larger river systems, but it was of sufficient magnitude to embrace practically the entire watershed of many of the small streams and rivers, particularly in northwestern Missouri, southwestern Iowa and northern Ohio.

Floods in Missouri.—The heavy rains of May and June in northeast Kansas and northwest Missouri continued during July. Some of the greatest monthly amounts are given below:

	Inches.
Maryville, Mo.	20.22
St. Joseph, Mo.	12.97
Manhattan, Kans.	12.38
Wamego, Kans.	10.33
Blue Rapids, Kans.	9.46
Beatrice, Nebr.	8.83
Hanover, Kans.	8.65
Clay Center, Kans.	7.85
Horton, Kans.	7.09

As a result of these heavy monthly rains the great bulk of the run-off was concentrated in the Missouri River, in the vicinity of Kansas City. The Kansas River was in flood in its lower stretches, as at Topeka, on but two days, the 17th and 18th, with a crest scarcely 1 foot above flood stage. The river, however, carried a large volume of water during the entire month, and was thus influential in keeping the Missouri at a high stage. The last named, above Kansas City, was also near bankfull stage on several days, and on the average carried a larger volume of water than usual. Thus it happened that the run-off from the heavy rains at the place above named was sufficient to cause the Missouri River at Kansas City to exceed the flood stage on 19 of the 31 days, as shown in the table below. Below Kansas City there were one major and two minor flood waves. The first, a minor wave, passed from Kansas City to Waverly, Mo., from the 1st to the 4th. Below Waverly it flattened out to slightly below bankfull stage. The second and principal flood of the month began at Kansas City on the 14th and continued until the 28th. This wave had not yet passed into the Mississippi at the close of the month. The second minor wave began at Kansas City on the 29th and had reached Boonville, Mo., at the end of the month. It was in progress down the river at the close of the month.

The details of the Missouri floods are shown in the table below:

Missouri River floods, July, 1915.

Stations.	Flood stage.	Above flood stage.		Crest.	
		From—	To—	Stage.	Date.
	Feet.			*Feet.*	
Townsend, Mont.	6.8	13	13	6.8	13
Do.	6.8	17	17	6.8	17
Running Water, S. Dak.	16.0	16	16	16.4	16
Blair, Nebr.	15.0	23	23	15.1	23
St. Joseph, Mo.	12.0	21	21	12.2	21
Kansas City, Mo.	22.0	1	3	23.9	2
Do.	22.0	14	28	[1] 29.0	21
Do.	22.0	29	31	25.0	31
Waverly, Mo.	22.0	3	3	22.0	3
Do.	22.0	14	28	25.9	22
Do.	22.0	31	31	22.7	31
Boonville, Mo.	21.0	16	30	25.0	20
Do.	21.0	31	31	21.1	31
Hermann, Mo.	21.0	18	29	24.3	21

[1] The crest stage of this flood at Kansas City was the highest July stage ever recorded at that place.

Floods in Mississippi River.—Two small flood waves were observed in the Mississippi during the month. The first passed Cape Girardeau, Mo., on the 1st, when the river was 3 feet above flood stage. This swell did not reach a flood stage at points between Cape Girardeau and Arkansas City, Ark. At the last named the crest of the wave was 1.8 feet above flood stage, and the river remained above flood stage from the 1st to the 13th. Below Arkansas City the swell flattened out.

The second wave was of about a week duration at St. Louis, Mo. It was preceded by several minor swells of short duration. The details may be seen in the subjoined table.

July floods in Mississippi River.

Stations.	Flood stage.	Above flood stage.		Crest.	
		From—	To—	Stage.	Date.
	Feet.			*Feet.*	
Quincy, Ill.	14.0	31	31	14.1	31
Hannibal, Mo.	13.0	26	26	13.0	26
Do.	13.0	30	31	14.2	31
Grafton, Ill.	18.0	15	16	18.1	16
Do.	18.0	22	24	18.2	23
Do.	18.0	27	28	18.0	28
St. Louis, Mo.	30.0	21	28	31.3	23
Cape Girardeau, Mo.	30.0	19	31	31.8	25
Do.	30.0	1	1	33.0	1
Arkansas City, Ark.	42.0	1	13	43.8	6

The Grand River of Missouri.—The Grand River was in the belt of almost continuous rains. At Chillicothe it passed above flood stage, 18 feet, on the 12th, crested at 29.7 feet on the 17th, and passed below the flood stage on the 29th.

Illinois River.—The upper Illinois River was in flood from the 13th to the 22d, inclusive, and in its lower reaches, as at Beardstown, from the 12th continuously until the end of the month.

Freshets in north-central Ohio.—Rainfalls during the first decade of July, followed by excessive precipitation on the 15th and 16th—from 4 to 5½ inches being recorded at stations in Harden, Allen, and Marion Counties—caused sharp rises in the upper branches of the Scioto and Sandusky Rivers and the Walhonding and other branches of the Muskingum. Much lowland property was overflowed; losses of stacked hay, grain, and growing crops exceeded in some localities the damage to farming interests caused by the spring flood of 1913. Loss due to destruction of crops in Harden County alone (mainly onions and sweet corn) is conservatively estimated at $2,000,000. Otherwise the damage to property interests, permanent works, etc., was comparatively unimportant. A table of crest stages at the several points affected is given below.

Crest stages in Ohio rivers, July, 1915.

Rivers and stations.	Flood stage.	Crest.	
		Stage.	Date.
	Feet.	Feet.	
Walhonding River:			
Walhonding, Ohio	8.0	12.6	16
Tuscarawas River:			
Coshocton, Ohio	8.0	9.1	17
St. Joseph River:			
Montpelier, Ohio	10.0	9.6	8
Olentangy River:			
Delaware, Ohio	9.0	13.2	16
Scioto River:			
Prospect, Ohio	10.0	14.9	18
Bellpoint, Ohio	9.0	10.8	16
Columbus, Ohio	17.0	18.1	17
Chillicothe, Ohio	14.5	15.5	19

Indiana.—Severe thunderstorms during July 8–9 brought heavy rains over the watershed of the upper Wabash River and tributaries, resulting in moderate flood stages and damage to lowland farming interests. As the water receded rapidly, a total loss of crops was suffered in but few localities. A table of crest stages in the Wabash and the White Rivers follows:

Crest stages in the Wabash and White Rivers, Indiana, July, 1915.

Rivers and stations.	Flood state.	Crest stages.	
		Crest.	Date.
	Feet.	Feet.	
Wabash River:			
La Fayette, Ind	11.0	14.5	17
Terre Haute, Ind	16.0	14.8	9
White, West Fork:			
Elliston, Ind	19.0	23.1	12
White River:			
Decker, Ind	18.0	18.2	16

Floods in North Branch of Susquehanna.—Heavy rains, July 8–9, caused severe local freshets and washouts in the upper tributaries and moderate flood stages south to Wilkes-Barre, Pa. Damage to crops, highways, bridges, and railway embankments has been variously estimated at from $300,000 to $600,000. All crops in bottom lands of the upper tributaries were under water from 5 to 12 days and will be a total loss.

Crest stages in the Unadilla and the Susquehanna (North Branch), July, 1915.

Rivers and stations.	Flood stage.	Crest stage.	
		Stage.	Date.
	Feet.	Feet.	
Unadilla River:			
New Berlin, N. Y.	9.0	9.9	9
Susquehanna, North Branch:			
Oneonta, N. Y.	10.0	15.4	9
Binghamton, N. Y.	14.0	15.2	9
Towanda, Pa.	16.0	17.5	9
Wilkes-Barre, Pa.	20.0	22.3	10
Harrisburg, Pa.	17.0	11.3	10

Red River and tributaries.—The Red River has been in frequent flood during the current season. Much loss has been sustained, due to the overflow of bottom lands. Moderate to heavy rains during the first week of the month caused flood stages to be reached and passed, as shown in the small table below:

Crest stages in the Red and Sulphur Rivers, July, 1915.

Rivers and stations.	Flood stage.	Above flood stage.		Crest stage.	Date.
		Fro—	To—		
	Feet.			Feet.	
Sulphur River:					
Finley, Tex.	24.0	4	10	27.4	5
Red River:					
Fulton, Ark.	28.0	6	9	28.6	7
Springbank, Ark.	29.0	11	12	29.3	11

SCATTERED FRESHETS.

The heavy rains of the 8th and 9th resulted in bankful stages at points on the Connecticut, Hudson, and Delaware Rivers. Highways were gullied and traffic delayed generally over a portion of Pennsylvania, New York, and the New England States. A table of crest stages at those stations which reached or exceeded flood stage is given below.

Crest stages in the Delaware, Hudson, and Connecticut, July, 1915.

Rivers and stations.	Flood stage.	Crest stage.	
		Crest	Date.
	Feet.	Feet.	
Delaware, East Branch:			
Fishs Eddy, N. Y.	10.0	10.4	9
Delaware, West Branch:			
Hale Eddy, N. Y.	12.0	11.9	9
Hudson River:			
Troy, N. Y.	14.0	15.7	11
Connecticut River:			
White River Junction, Vt.	13.0	12.9	10
Hartford, Conn.	16.0	16.4	10

Rio Grande River.—Exceptionally high water for July prevailed during the entire month at El Paso, Tex.; the river being above flood stage, 15 feet, from the 1st to the 4th, inclusive, and again on the 28th, 29th, and 31st. Heavy local rains in the vicinity of San Marcial, N. Mex., caused material damage to bridges, highways, railroad property, and growing crops.

Hydrographs for typical points on several principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and

Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

MEAN LAKE LEVELS DURING JULY, 1915.

By UNITED STATES LAKE SURVEY.

[Dated: Detroit, Mich., Aug. 5, 1915.]

The following data are reported in the Notice to Mariners of the above date:

Data.	Lakes.			
	Superior.	Michigan and Huron.	Erie.	Ontario.
Mean level during July, 1915:	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Above mean sea level at New York	602.29	579.92	572.08	245.13
Above or below—				
Mean stage of June, 1915	+0.34	+0.14	+0.22	+0.01
Mean stage of July, 1914	−0.39	−0.80	−0.74	−1.59
Average stage for July, last 10 years	−0.19	−1.12	−0.76	−1.83
Highest recorded July stage	−1.53	−3.66	−2.33	−3.59
Lowest recorded July stage	+0.81	+0.02	+0.62	+0.54
Probable change during August, 1915	+0.2	0.0	−0.2	−0.3

SECTION V.—SEISMOLOGY.

SEISMOLOGICAL REPORTS FOR JULY, 1915.

By WILLIAM J. HUMPHREYS, Professor in charge of Seismological Investigations.

[Dated: U. S. Weather Bureau, Washington, D. C., Aug. 30, 1915.]

TABLE 1.—*Noninstrumental earthquake reports, July, 1915.*

Day.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
	H. m.	CALIFORNIA.	° ′	° ′			*Sec.*			
3	23 45	Brawley	32 59	115 40						M. D. Witter.
13	5 43	Victorville	34 32	117 18						J. M. Henry.
15	18 00	Drakesbad	40 28	121 29	2	1		Faint		A. Sifford.
21	24 00	Drakesbad	40 28	121 29	3	1		Rumbling		A. Sifford.
22	11 00	Mineral	40 21	121 32	2	2				W. E. Gerber.
22	20 36	Eureka	40 48	124 11	2	1	5		Shook chandeliers	U. S. Weather Bureau.
27	19 43	Newhall	34 22	118 30	2	2	1			P. J. Coyle.
27	22 41	Newhall	34..22	118..30	2	1	½			P. J. Coyle.
		UTAH.								
15	22 00	Heber	40 35	111 28	5	1	2		Rattled dishes	John Cook.
	22 00	Lehi	40 23	111 52		1	10			Joseph Anderson.
	22 00	Midvale	40 36	111 53	5	4	8			E. D. Camomile.
	22 00	Park City	40 38	111 35	3			Rumbling		Geo. Cunningham.
	22 00	Provo	40 16	111 44	6	1	4	Rumbling	Cracked a few ceilings	U. S. Reclamation Service.
	22 00	Salt Lake City	40 46	111 54	3	1	10			U. S. Weather Bureau.
	22 00	Spanish Fork	40 08	111 44	2	1				W. P. Shippee.
	22 00	Thistle	40 00	111 36	3	1	4	Rumbling		R. H. Thomas.
30	19 50	Garland	41 45	112 11	5	2		Faint	Shook dishes from shelves	John T. Roberts.
		WASHINGTON.								
18	20 54	Lakeside	47 50	120 00	4	1		Faint		W. H. Van Meter.

TABLE 2.—*Instrumental seismological reports, July, 1915.*

Time used: Mean Greenwich, midnight to midnight. Nomenclature: International.

[For significance of symbols see this REVIEW, June, 1915, p. 289.]

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. J. W. Green.

Lat., 57° 03′ 00″ N.; long., 135° 20′ 06″ W. Elevation, 15.2 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants:

	V	T_0
E	10	17.4
N	10	15.6

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
uly 31	.....	P	1 38 19	3	.....	.....	.....	
		S	1 43 46	12	.....	.....	.....	
		L_E	1 50 14	21	.....	.....	.....	
		L_N	1 50 40	20	.....	.....	.....	
		M_E	1 51 42	18	970	.....	.....	
		M_N	1 52 15	18	.....	1,100	.....	
		C	1 54 00	16	.....	.....	.....	
		F	2 56 00	.....	.....	.....	.....	

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

Lat., 32° 14′ 48″ N.; long., 110° 50′ 06″ W. Elevation, 769.6 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants:

	V	T_0
E	10	16
N	10	19.6

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
July 31	.....	P_E	1 41 51	5	.....	.....	.....	
		P_N	1 41 56	4	.....	.....	.....	
		S_E	1 50 25	.....	.....	.....	.....	
		S_N	1 50 29	.....	.....	20	.....	
		L_E	2 02 38	22	.....	.....	.....	
		M_E	2 05 07	22	30	.....	.....	
		M_N	2 08 50	13	.....	10	.....	
		C	2 10 00	.....	.....	.....	.....	
		F	2 46 00	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, July, 1915*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
California. *Berkeley. University of California.* Lat., 37° 52′ 16″ N.; long., 122° 15′ 37″ W. Elevation, 85.4 meters. (See Bulletin of the Seismographic Stations, University of California.)								
California. *Mount Hamilton. Lick Observatory.* Lat., 37° 20′ 24″ N.; long., 121° 38′ 34″ W. Elevation, 1,281.7 meters. (See Bulletin of the Seismographic Stations, University of California.)								
California. *Point Loma. Raja Yoga Academy.* F. J. Dick. Lat., 32° 43′ 03″ N.; long., 117° 15′ 10″ W. Elevation, 91.4 meters. Instrument: Two-component, C. D. West seismoscope.								
1915. July 11 to 12.	.....	.....	*H. m. s.*	*Sec.*	μ *100	μ *100	*Km.*	No time obtained. Light tremors.
Colorado. *Denver. Sacred Heart College. Earthquake Station.* A. W. Forstall, S. J. Lat., 39° 40′ 36″ N.; long., 104° 56′ 54″ W. Elevation, 1,655 meters. Instrument: Wiechert 80 kg., astatic, horizontal pendulum.								
1915. July 1-2	.....	.....	*H. m. s.*	*Sec.*	μ	μ	*Km.*	Constant activity at intervals on N-S. Only thickening of pen marks on E-W. Waves are broken and irregular.
3-4	.....	.....	.....	.....	.....	.....	.....	Activity at intervals on N-S.
4-5	.....	.....	.....	.....	.....	.....	.....	Activity on N-S.
16	.....	.....	.....	.....	.....	.....	.....	Activity on both components, especially E-W, from 3h to 5h.
21	.....	.....	9 00 00	.....	.....	.....	.....	Small but distinct oscillations at intervals on N-S.
			13 00 00	.....	.....	.....	.....	
31	I_u...	P_N....	1 49 00	.....	.....	.....	.....	P disturbed through minute marks. S not visible.
		L_N....	2 01 00	.....	.....	.....	.....	
		M_N....	2 03 00	20	.....	6	.....	
		C_N....	2 05 00	.....	.....	.....	.....	
		F_N....	2 07 00	.....	.....	.....	.....	
31	.....	.....	11 48 00	.....	.....	.....	.....	Wavelets on N-S.
			12 04 00	.....	.....	.....	.....	
District of Columbia. *Washington. U. S. Weather Bureau.* Lat., 38° 54′ N.; long., 77° 03′ W. Elevation, 21 meters. Instrument: Marvin (vertical pendulum), undamped. Mechanical registration. Instrumental constants.. V 110, T_0 6								
1915. July 16	I_v...	P_E....	*H. m. s.* 20 33 45	*Sec.*	μ	μ	*Km.* 810?	Long waves doubtful.
		S_E....	20 35 13	.....	.....	.....	.....	
		M_E....	20 37 25	.....	7	.....	.....	
		F.....	20 54 00	.....	.....	.....	.....	
22	I_r...	P_E....	4 16 53	.....	.....	.....	3,995?	Phases doubtful.
		S_E....	4 22 40	.....	.....	.....	.....	
		L_E....	4 29 40	12	.....	.....	.....	
		F.....	4 45 00	.....	.....	.....	.....	
25	I_u...	P_E?...	21 03 15	.....	.....	.....	7,235?	P and S very doubtful.
		S_E?...	21 11 56	.....	.....	.....	.....	
		L_E....	21 16 40	.....	.....	.....	.....	
		F.....	21 45 00	.....	.....	.....	.....	

* Amplitude on instrument.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
District of Columbia. *Washington. U. S. Weather Bureau*—Contd.								
1915. 29	.....	e_E....	*H. m. s.* 10 49 30	*Sec.*	μ	μ	*Km.*	Phases uncertain
		L_E....	10 51 40	.....	.....	.....	.....	
		F.....	11 10 00	.....	.....	.....	.....	
31	I_u...	P_E....	1 43 01	.....	.....	.....	8,165	
		S_N....	1 52 29	.....	.....	.....	.....	
		L_E....	2 01 00	18	.....	.....	.....	Long waves continued with approximately the same magnitude until 2h 25m with a period of 20-24 seconds.
		F_E....	4 00 00	.....	.....	.....	.....	
District of Columbia. *Washington. Georgetown University.* F. L. Tondorf, S. J. Lat., 38° 54′ 25″ N.; long., 77° 04′ 24″ W. Elevation, 42.4 meters. Subsoil: Decayed diorite. Instruments: Wiechert 200 kg., astatic horizontal pendulums. Instrumental constants.. V E 165, N 143; T_0 E 5.4, N 5.2; ϵ E 2.6, N 3.4								
1915. July 31	I....	eP_E...	*H. m. s.* 1 36 43	*Sec.*	μ	μ	*Km.*	
		eP_N...	1 36 46	3	.....	.....	.....	
		S_E....	1 46 13	.....	.....	.....	.....	
		S_N....	1 46 24	12	.....	.....	.....	
		L_N....	2 07 40	20	.....	.....	.....	
		M_N....	2 11 46	18	.....	2	.....	
		F_N....	2 57 16	.....	.....	.....	.....	
Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. W. Merrymon. Lat., 21° 19′ 12″ N.; long., 158° 03′ 48″ W. Elevation, 15.2 meters. Instruments: Milne seismograph of the Seismological Committee of the British Association. Instrumental constant.. T_0 18.9								
1915. July 2	.....	eL....	*H. m. s.* 14 00 36	*Sec.*	μ	μ	*Km.*	
		M.....	14 10 12	.....	*100	.....	.....	
		C.....	14 26 36	.....	.....	.....	.....	
4	.....	eL....	2 28 54	.....	.....	.....	.....	
		M.....	2 39 00	.....	*100	.....	.....	
		F.....	2 48 30	.....	.....	.....	.....	
8	.....	P.....	22 36 36	.....	.....	.....	.....	
		S.....	22 41 12	.....	.....	.....	.....	
		L.....	22 45 12	.....	.....	.....	.....	
		M.....	22 57 48	24	*300	.....	.....	
		C.....	23 05 48	.....	.....	.....	.....	
		F.....	23 23 54	.....	.....	.....	.....	
10	.....	eL....	1 01 48	.....	.....	.....	.....	
		M.....	1 02 42	20	*100	.....	.....	
		F.....	1 10 12	.....	.....	.....	.....	
13	.....	eL....	19 45 00	.....	.....	.....	.....	
		M.....	19 51 12	18	*100	.....	.....	
		C.....	19 55 36	.....	.....	.....	.....	
		F.....	20 03 36	.....	.....	.....	.....	
24	.....	eL....	19 18 54	.....	.....	.....	.....	
		M.....	19 27 36	.....	*100	.....	.....	
		C.....	19 31 00	.....	.....	.....	.....	
		F.....	19 42 54	.....	.....	.....	.....	
25	.....	eL....	21 02 54	.....	.....	.....	.....	
		M.....	21 04 12	.....	*100	.....	.....	
		F.....	21 14 42	.....	.....	.....	.....	
28	.....	eL....	9 27 00	.....	.....	.....	.....	
		M.....	9 42 48	20	*200	.....	.....	
		C.....	9 48 48	.....	.....	.....	.....	
		F.....	10 03 42	.....	.....	.....	.....	
31	.....	P.....	1 40 12	.....	.....	.....	.....	From 1h 52m 12s to 1h 56m 48s amplitude exceeded width of record.
		S.....	1 46 18	.....	.....	.....	.....	
		L.....	1 52 30	22	.....	.....	.....	
		C.....	3 14 36	.....	.....	.....	.....	
		F.....	5 35 48	.....	.....	.....	.....	

* Trace amplitude.

pages 359 – 374 follow supp. no. 2 at end of vol.

TABLE 2.—*Instrumental seismological reports, July, 1915*—Continued.

Kansas. *Lawrence. University of Kansas.* Department of Physics and Astronomy. F. E. Kester.

Lat., 38° 57′ 30″ N.; long., 95° 14′ 58″ W. Elevation, 304.8 meters.

Instrument: Wiechert.

Instrumental constants.. V: E 177, N 205; T_0: 3.4, 3.4; ε: 4.0, 3.8

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915. July 31	.....	P.....	*H. m. s.* 1 41 51	*Sec.* 2	μ	μ	*Km.*	
		S.....	1 50 46	5–8	.....	.....	.....	
		L.....	2 06 52	24	15	8	.....	

Maryland. *Cheltenham. Magnetic Observatory.* U. S. Coast and Geodetic Survey. George Hartnell.

Lat., 38° 44′ 00″ N.; long., 76° 50′ 30″ W. Elevation, 71.6 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants.. V: E 10, N 10; T_0: 31, 29

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915. July 31	.....	P_E.....	*H. m. s.* 1 43 28	*Sec.* 2	μ	μ	*Km.*	
		P_N.....	1 43 32	2	.....	.....	.....	
		S_N.....	1 53 34	12	.....	.....	.....	
		L_E.....	2 05 00	24	.....	.....	.....	
		L_N.....	2 06 44	26	.....	.....	.....	
		M_E.....	2 08 52	32	30	.....	.....	
		M_N.....	2 17 20	22	.....	180	.....	
		C_E.....	2 18 00	16	.....	.....	.....	
		C_N.....	2 22 00	19	.....	.....	.....	
		F_E.....	2 28 00	20	.....	.....	.....	
		F_N.....	3 17 00	20	.....	.....	.....	

Missouri. *Saint Louis. St. Louis University.* Geophysical Observatory. J. B. Goesse, S. J.

Lat., 38° 38′ 15″ N.; long., 90° 13′ 58″ W. Elevation, 160.4 meters. Foundation: 12 feet of tough clay over limestone of Mississippi system, about 300 feet thick.

Instrument: Wiechert 80 kg. astatic, horizontal pendulum.

Instrumental constants.. V: 80; T_0: 7; ε: 5:1

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915. July 31	I_r...	P_E.....	*H. m. s.* 1 42 30	*Sec.*	μ	μ	*Km.* 7,600	Phases and times on N–S component same as on E–W. 4 after-shocks registered on both components, with maximum amplitudes of 2 mm. and uniform periods of 18 seconds.
		S_E.....	1 51 30	.....	.....	.....	.....	
		L_E.....	1 59 00	.....	.....	.....	.....	
		F.....	3 12 00	.....	.....	.....	.....	

New York. *Buffalo. Canisius College.* John A. Curtin, S. J.

Lat., 42° 53′ 02″ N.; long., 78° 52′ 40″ W. Elevation, 190.5 meters.

Instrument: Wiechert 80 kg. horizontal.

Instrumental constants.. V: 80; T_0: 7; ε: 5:1

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915. July 5	I....	iL_E...	*H. m. s.* 19 48 30	*Sec.* 10	24	.....	*Km.*	P and S not discernible on either component.
		iL_N...	19 48 40	4	.....	10	.....	
		L_N...	19 49 00	.....	.....	.....	.....	
		L_E...	19 49 10	.....	.....	.....	.....	
8	.....	.....	.....	.....	.....	.....	.....	Microseisms on E–W component from 17^h 56^m to 17^h 58^m.
8	I....	.....	17 56 10	.....	.....	.....	.....	Mild shock from south.
9	.....	.....	.....	.....	.....	.....	.....	Microseisms on E–W component from 16^h 22^m to 19^h 00^m.
12	I....	.....	22 11 15	.....	.....	.....	.....	Shock from southwest.
31	I_e...	eP_N...	1 42 10	2	.....	.....	8,000	
		eP_E...	1 42 30	2	.....	.....	.....	
		eS_N...	1 51 30	3	.....	.....	.....	
		eS_E...	1 51 30	5	.....	.....	.....	
		iL_N...	2 06 00	10	.....	10	.....	
		iL_E...	2 08 00	20	13	.....	.....	
		M_E...	2 14 30	30	.....	.....	.....	
		L.....	2 16 00	.....	.....	.....	.....	
		C_N...	2 28 00	.....	.....	.....	.....	
		C_E...	2 30 00	.....	.....	.....	.....	

New York. *Fordham. Fordham University.* W. C. Repetti, S. J.

Lat., 40° 57′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert 80 kg.

Instrumental constant.. T_0: 6

(Report for July, 1915, not received.)

Panama Canal Zone. *Balboa Heights.* Isthmian Canal Commission.

Lat., 8° 57′ 39″ N.; long., 79° 33′ 29″ W. Elevation, ——.

Instruments: Two Bosch-Omori 25 kg.

Instrumental constants.. V: 8; T_0: 20

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915. July 14	I_r....	P.....	*H. m. s.* 10 57 10	*Sec.*	μ	μ	*Km.* 328	Probable direction southwest.
		L.....	10 57 58	.....	.....	.....	.....	
		M_E.....	10 58 04	.....	25	.....	.....	
		M_N.....	10 58 04	.....	.....	62	.....	
		F_E.....	11 01 00	.....	.....	.....	.....	
		F_N.....	11 01 40	.....	.....	.....	.....	

Vermont. *Northfield. U. S. Weather Bureau.* Wm. A. Shaw.

Lat., 44° 10′ N.; long., 72° 41′ W. Elevation, 256 meters.

Instruments: Two Bosch-Omori, mechanical registration.

Instrumental constants: V: E 10, N 10; T_0: 15, 16

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915 July 31	I_e...	P_N.....	*H. m. s.* 1 42 47	*Sec.*	.....	.....	*Km.* 7,990	
		S_E.....	1 52 06	.....	.....	.....	.....	
		L.....	2 00 10	.....	.....	.....	.....	
		L.....	2 15 00	24	.....	.....	.....	
		L.....	2 22 40	18	.....	.....	.....	
		F.....	3 10 00	.....	.....	.....	.....	

Canada. *Ottawa. Dominion Astronomical Observatory.* Earthquake Station. Otto Klotz.

Lat., 42° 23′ 38″ N.; long., 75° 42′ 57″ W. Elevation, 83 meters.

Instruments: Two Bosch photographic horizontal pendulums, one Spindler & Hoyer 80 kg. vertical seismograph.

Instrumental constants: V: 120; T_0: 26

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915 July 22	.....	P.....	*H. m. s.* 4 23 00	*Sec.*	.....	.....	*Km.* 3,480	
		S.....	4 28 16	.....	.....	.....	.....	
		L.....	4 32 07	19	.....	.....	.....	
		F.....	4 45 00	.....	.....	.....	.....	
25	.....	P.....	21 05 13	.....	.....	.....	4,520	
		S.....	21 14 36	.....	.....	.....	.....	
		L.....	21 16 05	25	.....	.....	.....	
		F.....	21 40 00	.....	.....	.....	.....	
29	.....	L.....	10 55 05	12	.....	.....	.....	
31	.....	iP.....	1 42 32	.....	.....	.....	7,700	
		$PR1_E$..	1 45 20	.....	.....	.....	.....	
		$PR2_E$..	1 47 01	.....	.....	.....	.....	
		S_N.....	1 51 37	.....	.....	.....	.....	
		S_E.....	1 51 38	.....	.....	.....	.....	
		L.....	1 59 07	60	.....	.....	.....	
		L.....	2 04 00	40	.....	.....	.....	
		L.....	2 09 00	28	.....	.....	.....	
		L.....	2 22 00	18	.....	.....	.....	
		L.....	3 00 00	14	.....	.....	.....	
		F?.....	4 30 00	.....	.....	.....	.....	

Canada. *Toronto. Dominion Meteorological Service.*

Lat., 43° 40′ 01″ N.; long., 79° 23′ 54″ W. Elevation, 113.7 meters. Subsoil: Sand and clay.

Instrument: Milne horizontal pendulum, North. In the meridian.

Instrumental constant: T_0: 18. Pillar deviation, 1 mm. swing of boom = 0.59″.

(Report for July, 1915, not received.)

Canada. *Victoria, B. C. Dominion Meteorological Service.*

Lat., 48° 24′ N.; long., 123° 19′ W. Elevation, 67.7 meters. Subsoil: Rock.

Instrument: Milne horizontal pendulum, North. In the meridian.

Instrumental constant: T_0: 18. Pillar deviation, 1 mm. swing of boom = 0.54″.

(Report for July, 1915, not received.)

TABLE 3.—*Late seismological reports. (Instrumental.)*

Canada. *Toronto. Dominion Meteorological Service.*

Lat., 43° 40′ 01″ N.; long., 79° 23′ 54″ W. Elevation, 113.7 meters. Subsoil: Sand and clay.

Instrument: Milne horizontal pendulum, North. In the meridian.

Instrumental constant..18. T_0 Pillar deviation, 1mm. swing of boom=0.59″.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
June 1	.....	iP?....	14 57 36	.....	*300	.....	3,245?	
		iS?....	15 05 18	.....	.....	.....	.....	
		iL.....	15 07 30	.....	.....	.....	.....	
		L.....	15 09 54	.....	.....	.....	.....	
		M.....	15 11 18	.....	*13,200	.....	.....	
		M.....	15 12 24	.....	*13,000	.....	.....	
		M.....	15 12 42	.....	*12,100	.....	.....	
		C.....	15 13 24	.....	*900	.....	.....	
		C.....	15 13 42	.....	.....	.....	.....	
		L.....	15 31 54	.....	.....	.....	.....	
		M.....	15 32 30	.....	*100	.....	.....	
		F.....	16 30 12	.....	.....	.....	.....	
4	.....	P.....	21 23 24	.....	.....	.....	.....	
		L.....	21 38 12	.....	*50	.....	.....	
		F.....	22 19 18	.....	.....	.....	.....	
4	.....	iP.....	22 30 06	.....	.....	.....	.....	
		L.....	22 44 48	.....	.....	.....	.....	
		L.....	22 52 00	.....	.....	.....	.....	
		M.....	22 56 00	.....	*200	.....	.....	
		F.....	23 21 18	.....	.....	.....	.....	
6	.....	P.....	15 48 48	.....	.....	.....	.....	
		L.....	15 55 30	.....	.....	.....	.....	
		M.....	15 57 12	.....	*200	.....	.....	
		F.....	16 01 36	.....	.....	.....	.....	
6	.....	iP.....	20 21 30	.....	.....	.....	.....	
		iS.....	20 28 48	.....	.....	.....	.....	
		L.....	20 39 24	.....	.....	.....	.....	
		L.....	20 41 42	.....	.....	.....	.....	
		M.....	20 48 42	.....	*300	.....	.....	
		L.....	20 52 42	.....	.....	.....	.....	
		L.....	21 12 24	.....	.....	.....	.....	
		F.....	21 18 12	.....	.....	.....	.....	
6	.....	P.....	21 36 06	.....	.....	.....	.....	
		P.....	21 38 12	.....	.....	.....	.....	
		P.....	21 40 48	.....	.....	.....	.....	
		S.....	21 48 24	.....	.....	.....	.....	
		L.....	21 49 24	.....	.....	.....	.....	
		M.....	21 51 30	.....	*5,000	.....	.....	
		M.....	21 56 30	.....	.....	.....	.....	
		C.....	21 56 36	.....	*4,000	.....	.....	Long waves continued for a long time.
		C.....	21 59 00	.....	*4,000	.....	.....	
		C.....	22 00 30	.....	.....	.....	.....	
		L.....	22 09 12	.....	.....	.....	.....	
		M.....	22 11 06	.....	*4,000	.....	.....	
		C.....	22 13 36	.....	.....	.....	.....	
		L.....	22 14 36	.....	.....	.....	.....	
		L.....	22 22 06	.....	.....	.....	.....	
		L.....	23 16 00	.....	.....	.....	.....	
		L.....	23 34 06	.....	.....	.....	.....	
		F.....	23 32 00	.....	.....	.....	.....	
7	.....	L.....	12 27 54	.....	*50	.....	.....	
		F.....	12 36 00	.....	.....	.....	.....	
7	.....	L?....	22 48 54	.....	.....	.....	.....	
		L.....	22 52 00	.....	.....	.....	.....	
		M.....	22 52 42	.....	*200	.....	.....	
		F.....	23 06 54	.....	.....	.....	.....	
11	.....	L.....	7 37 12	.....	*100	.....	.....	
		F.....	7 36 48	.....	.....	.....	.....	
12	.....	L.....	6 43 24	.....	.....	.....	.....	
		M.....	6 44 00	.....	*100	.....	.....	
		F.....	6 49 48	.....	.....	.....	.....	
22	.....	L.....	3 44 00	.....	.....	.....	.....	Marked quake, P possibly not recorded.
		M.....	3 45 18	.....	*300	.....	.....	
		F.....	4 13 30	.....	.....	.....	.....	
22	.....	L.....	13 05 18	.....	*50	.....	.....	
		F.....	13 13 24	.....	.....	.....	.....	
23	.....	P.....	4 06 06	.....	.....	.....	3,880	Origin in southern California.
		iS.....	4 14 42	.....	.....	.....	.....	
		L.....	4 17 36	.....	.....	.....	.....	
		M.....	4 17 36	.....	*400	.....	.....	
		F.....	4 34 00	.....	.....	.....	.....	

* Trace amplitude.

Canada. *Toronto. Dominion Meteorological Service*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H.m.s.*	*Sec.*	μ	μ	*Km.*	
23	.....	P.....	5 06 00	.....	.....	.....	3,880	Origin in southern California.
		S.....	5 10 36	.....	.....	.....	.....	
		L.....	5 12 30	.....	.....	.....	.....	
		M.....	5 12 42	.....	*400	.....	.....	
		F.....	5 32 48	.....	.....	.....	.....	
27	.....	L.....	16 16 36	.....	.....	.....	.....	P lost on account of air currents.
		M.....	16 18 36	.....	*300	.....	.....	
		F.....	.....	.....	.....	.....	.....	F uncertain on account of air currents.
29	.....	L.....	14 42 06	.....	.....	.....	.....	F lost in air currents.
		L.....	14 53 36	.....	.....	.....	.....	
		M.....	14 55 24	.....	*100	.....	.....	

Canada. *Victoria, B. C. Dominion Meteorological Service.*

Lat., 48° 24′ N.; long., 123° 19′ W. Elevation, 67.7 meters. Subsoil: Rock.

Instrument: Milne horizontal pendulum, North. In the meridian.

Instrumental constant.. 18. T_0 Pillar deviation, 1 mm. swing of boom=0.54″.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
June 1	.....	iP.....	15 00 18	.....	.....	.....	.....	
		S.....	15 03 18	.....	*3,200	.....	.....	
		L.....	15 07 48	.....	.....	.....	.....	
		L.....	15 09 36	.....	.....	.....	.....	
		M.....	15 10 48	.....	*6,000	.....	.....	
		F.....	16 14 18	.....	.....	.....	.....	
6	.....	L.....	20 20 24	.....	.....	.....	.....	P lost in attention to instrument.
		L.....	20 21 00	.....	.....	.....	.....	
		M.....	20 33 36	.....	*870	.....	.....	
		F.....	20 38 24	.....	.....	.....	.....	
6	.....	P.....	21 42 24	.....	.....	.....	.....	
		L.....	21 43 24	.....	.....	.....	.....	
		M.....	21 43 24	.....	*1,000	.....	.....	
		F.....	21 48 24	.....	.....	.....	.....	
6	.....	P.....	21 49 54	.....	.....	.....	.....	
		L.....	21 51 54	.....	.....	.....	.....	
		M.....	21 53 30	.....	*3.000	.....	.....	
		F.....	(?)	.....	.....	.....	.....	
6	.....	P.....	22 11 12	.....	.....	.....	.....	
		L.....	22 15 06	.....	.....	.....	.....	
		M.....	22 20 42	.....	*2,000	.....	.....	
7	.....	F.....	0 18 24	.....	.....	.....	.....	
11	.....	P.....	6 57 42	.....	.....	.....	.....	
		L.....	7 03 42	.....	.....	.....	.....	
		M.....	7 16 42	.....	*200	.....	.....	
		F.....	7 26 42	.....	.....	.....	.....	
22	.....	P.....	3 45 00	.....	.....	.....	.....	
		L.....	3 47 30	.....	.....	.....	.....	
		M.....	3 48 00	.....	*200	.....	.....	
		F.....	3 58 00	.....	.....	.....	.....	
22	.....	L.....	13 10 00	.....	.....	.....	.....	Measurements doubtful.
		M.....	13 13 48	.....	*50	.....	.....	
23	.....	P.....	4 07 42	.....	.....	.....	.....	Origin in southern California.
		L.....	4 11 00	.....	.....	.....	.....	
		M.....	4 12 30	.....	*1,000	.....	.....	
		F.....	4 18 00	.....	.....	.....	.....	
23	.....	P.....	5 04 00	.....	.....	.....	.....	Origin in southern California.
		L.....	5 07 30	.....	.....	.....	.....	
		M.....	5 09 00	.....	*1,200	.....	.....	
		F.....	5 22 00	.....	.....	.....	.....	
27	.....	P.....	15 53 00	.....	.....	.....	.....	
		L.....	16 04 30	.....	.....	.....	.....	
		M.....	16 16 00	.....	*200	.....	.....	
		F.....	16 26 00	.....	.....	.....	.....	
29	.....	P.....	14 25 00	.....	.....	.....	.....	
		S.....	14 28 00	.....	.....	.....	.....	
		L.....	14 41 00	.....	.....	.....	.....	
		M.....	14 43 00	.....	*200	.....	.....	
		F.....	15 03 00	.....	.....	.....	.....	

* Trace amplitude.

DETECTION OF SEISMIC ZONES BY MEANS OF BAROMETRIC GRADIENT.[1]

By A. NAKAMURA.

[*Reprinted from* Science Abstracts, Sec. A, July 26, 1915, §815.]

The barometric gradient as a secondary cause of earthquake has already been discussed by Terada [Abs. 778 (1909)] and by Hasegawa. The latter has shown that the barometric gradient in Gihu district at the epoch when an earthquake in that district occurs, is generally perpendicular to the dislocation line of the Mino-Owari earthquake in 1891. Nagaoka suggested that if such is the case in general a clue may be found for detecting the direction of some unknown seismic zones or dislocation lines. The method, if feasible, will probably be more accurate than to construct the zones statistically by locating a large number of epicenters. The present author, to test the general applicability of the method, has taken 50 earthquakes, all weak or slight, observed in Tukuba during 1904. Hasegawa's method was adopted of taking the barometric pressure just at the moment of the earthquake by graphical interpolation from 4 observations, while the gradients were given by Okada's process. Tables are given, and the result is found that the direction of the prevailing gradient at the epoch of earthquakes is nearly perpendicular to the seismic zone found by Omori from statistical grouping of epicenters. This confirms Hasegawa's results and realizes Nagaoka's suggestion.—*H. H. Ho[dgson]*.

[1] *See* Proc. Mathematical-physical Society, Tokyo, 1915, 8 : 69-72.

SECTION VI.—BIBLIOGRAPHY.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

C. FITZHUGH TALMAN, Professor in charge of Library.

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies.

Arctowski, Henryk.
Volcanic dust veils and climatic variations. New York. 1915. 149–174 p. 24½ cm. (*Reprint:* Annals of the New York academy of sciences, v. 26.)

Baden. Zentralbureau für Meteorologie und Hydrographie.
Niederschlagsbeobachtungen. Jahrgang 1914. 2. Halbjahr. Karlsruhe. 1915. 25 p. 29½ cm.

Batavia. Royal magnetical and meteorological observatory.
Observations made at secondary stations in Netherlands East-India. v. 2 (1912). Batavia. 1915. ix, 74 p. 36½ cm.

Borowsky, M[ax].
III. Beitrag zum Klima Kärntens. Luftwärme, Niederschlag und Schneeverhältnisse in Techendorf am Weissensee. Klagenfurt. 26–50 p. 23 cm. (Sonderabdruck aus Carinthia II, Mitteilungen des Vereines "Naturhist. Landesmuseum für Kärnten," 104. Jahrgang, 1914.)

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Report on the meteorology of the calendar year 1913. n. p. [1914.] 17 p. 33½ cm. (Reports of the Department, 1913–1914, app. 7.)

Cambridge university. Solar physics observatory.
Second annual report, 1914 April 1—1915 March 31. [Cambridge. 1915.] 8 p. 28 cm.

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Anales, no. 4. Observaciones meteorológicas de 1914. Habana. 1914. 7 p. tables. 33½ cm.

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Report of the meteorological committee, 1914. (*In* Proc. & trans. of the society, Croydon, v. 8, pt. 1, p. 33 ffg.)

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Observation des orages de 1914. Expériences des paragrêles électriques. Rapport de F. Courty. Bordeaux. 1915. 25 p. 24½ cm.

Gorczyński, Władysław.
O zmianach długoletnich temperatury powietrza w Polsce i w Eurazyi. Sur les variations de longue durée de la température de l' air en Pologne et en Eurasie. [Polish text; French résumé.] Warszawa. 1915. 81–107 p. 25½ cm. (Extrait des Comptes rendus de la Soc. des sciences de Varsovie, 1915, 8 année, fasc. 2.)
O zniżkach promienieowania w roku 1912 i 1903. (Z pracowni meteorologicznej przy Towarzystwie naukowem Warszawskiem.) Sur les dépressions en 1912 et 1903 dans les valeurs de l' intensité du rayonnement solaire. [Polish text; French résumé.] Warszawa. 1914. 29 p. 25½ cm. (Extrait des Comptes rendus de la Soc. des sciences de Varsovie, 1914, 7 année, fasc. 3.)
Stan obecny badań nad obrotem ciepła w wartwach gruntowych, oraz w wodach i w atmosferze. État actuel des études sur la circulation de la chaleur dans les couches du sol, dans les eaux et dans l'atmosphère. [Polish text; French résumé. Warszawa. 1915. 44 p. 25½ cm. (Extrait des Comptes rendus de la Soc. des sciences de Varsovie, 1915, 8 année, fasc. 1.)
Wyniki badań dotychczasowych nad redukcyą temperatur średnich powietrza do wartości średnich rzeczywistych. [In Polish.] Warszawa. 1914. 25–34 p. 28½ cm. (Odbitka z tomu 22-go Pamiętnika fizyograficznego.)

India. Meteorological department.
Rainfall of India. 23d year, 1913. Calcutta. 1914. v. p. 34 cm.

Indo-China. Service météorologique.
Bulletin pluviométrique. Tableaux mensuels, annuels et carte. Année 1914. Phu-Lien. 1915. unp. 39½ cm.

Kuchino. Institut aérodynamique.
Bulletin. Fascicule 5. Moscou. 1914. 296 p. plates. 28 cm.

Loanda. Observatório meteorológico e magnético.
Gráficos da frequência dos ventos no decénio de 1901 a 1910. Loanda. 1915. 12 plates. 35½ cm. (Apenso ao Boletím oficial da província de Angola, no. 24, 1915.)

Malone, R. E.
Smudging an orchard with native material in Alabama. [Tuskegee Institute, Ala.] n. d. 8 p. 23 cm. (Tuskegee experiment station. Bulletin no. 23.)

Manchester, England. Sanitary committee.
Report on the subject of air pollution, [containing the first report of the Air pollution advisory board]. [Manchester.] 1915. 42 p. 24½ cm.

Mauritius. Royal Alfred observatory.
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Through Siberia, the land of the future; translated by Arthur G. Chater. London. 1914. xvi, 478 p. plates. maps. 25½ cm. [Contains scattered references to climate. Appendix gives a chronology of ice conditions in the Kara Sea, 1556–1912; also average summer and winter temperatures in the surrounding region.]

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Wenger, R.
Über methodische Fehler der aerologischen Beobachtungen. Leipzig. 1915. 217–240 p. 24½ cm. (Veröff. des Geophysikalischen Instituts der Universität Leipzig, 2. Serie, Heft 9.)

RECENT PAPERS BEARING ON METEOROLOGY AND SEISMOLOGY.

C. FITZHUGH TALMAN, Professor in charge of Library.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers and other communications bearing on meteorology and cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled. It shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau.

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Icebergs and their detection. The international patrol and the valuable work accomplished by it. p. 110–111. [Extract from U. S. Coast guard, Bull. 3.]

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Schuchert, Charles. Climates of geologic time. p. 277–311. [Revised and reprinted from E. Huntington's "The climatic factor."]

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Cederberg, Ivar F. Über die Berechnung von Dampfdruckkurven Erste Mitteilung. p. 1–71. (no: 7).

NOTES FROM THE WEATHER RUREAU LIBRARY.

C. FITZHUGH TALMAN, Professor in charge of Library.

A TENTATIVE CLASSIFICATION FOR METEOROLOGICAL LITERATURE.

(Adapted from the scheme used in the International Catalogue of Scientific Literature.)

By Miss ELEANOR BUYNITZKY.

00 General works
Philosophy, theories, etc.

01 Mythology. History
02 Biography
03 Dictionaries. Encyclopædias
04 Periodicals. Reports of institutions, societies, etc.
05 Bibliographies
06 General treatises, text-books, etc.
07 Addresses, lectures, etc., of a miscellaneous character
08 Study and teaching
09 Expeditions. Travels

10 Observatories. Methods of observation

11 Construction, equipment and inspection of observatories
12 Instructions for observers
13 Tables for reductions
14 Computation of mean results
15 Applications of the theory of probability
16 Periodicity, analysis and computation

20 Instruments

See also 32.1, Dust-counters; 81, Atmospheric electricity—apparatus and methods; 38.1, Aerological apparatus and methods.

21 For measuring temperature and radiation
Thermometers, thermographs, pyrheliometers, sunshine recorders, etc.

22 For measuring atmospheric pressure
Barometers, barographs, etc.

23 For measuring humidity
Hygrometers, hygrographs, psychrometers, etc.

24 For measuring precipitation
Rain-gages, snow-gages, etc.

25 For measuring evaporation
Atmometers, atmographs, etc.

26 For measuring wind
Wind-vanes, anemometers, anemographs, etc.

27 For measuring clouds
Nephoscopes, etc.

28 Meteorographs

29 Miscellaneous

30 Physics of the atmosphere. Cosmical relations. Aerology

31 Extent and composition of the atmosphere

32 Impurities

32.1 Dust-counters

33 Mechanics of the atmosphere

34 Acoustic phenomena

35 Optical phenomena

35.1 Astronomical refraction, scintillation, mirage
.2 Polarization of skylight
.3 Colors of the sky, twilight phenomena
.4 Transparency
.5 Halos, coronas, rainbows

36 Atmosphere of planets

37 Cosmical relations

37.1 Solar
.2 Lunar
.3 Planetary
.4 Phenomena attending eclipses

38 Aerology [1]

38.1 Aerological apparatus and methods
.2 Aerological observations

39 Aeronautical meteorology
Subdivided geographically if desired.

40 Pressure

41 Distribution at earth's surface

42 Vertical distribution

43 Reduction to sea level, hypsometry

44 Periodic variations

45 Non-periodic variations

50 Temperature. Radiation

51 Atmospheric temperature

51.1 Distribution at earth's surface
.2 Vertical distribution
.3 Periodic variations
.4 Non-periodic variations
.5 Maximum and minimum temperatures
.6 Frosts and cold periods

[1] Upper-air or free-air investigations with kites, balloons, etc.

52 Earth temperature

52.1 Surface
.2 Vertical variation
.3 Frozen soil

53 Sea temperature

53.1 Surface
.2 Vertical variation
.3 Frozen sea

54 Temperature of springs, rivers, lakes

54.1 Springs
.2 Rivers
.3 Lakes
.4 Anchor ice

55 Solar radiation

55.1 Atmospheric absorption
.2 Atmospheric radiation
.3 Terrestrial radiation
.4 Sunshine

60 Atmospheric moisture

61 Humidity, relative humidity, vapor tension

61.1 Vertical distribution
.2 Periodic variation

62 Evaporation

63 Condensation

64 Fog, mist

65 Cloud

65.1 Geographical distribution

66 Precipitation
See also, under Hydrology, 67.3 and 67.5.

66.1 Geographical distribution
.2 Variation with altitude
.3 Periodicity
.4 Excessive falls. Droughts
.5 Percolation
.6 Dew, hoar frost. Rime.[2] Glazed frost[3] ("silver thaw," "ice storm")
.7 Rain
.71 Artificial production
.8 Hail, sleet, snow
.9 Other solid precipitates
Dust falls, "blood rain", "ink rain", etc.

67 Hydrology

67.1 Lake and river fluctuations
.2 Floods
.3 Relation of precipitation to water supply and stream flow
.4 Relation of vegetation (forests, etc.) to water supply and stream flow

70 Circulation of the atmosphere

71 Wind in general

71.1 Geographical distribution
.2 Relation to atmospheric pressure
.3 Variations
.4 Wind pressure

72 Permanent winds
Trades, counter-trades, westerlies of middle latitudes.[4]

[2] A rough deposit of frozen moisture due to fog.
[3] A smooth deposit of frozen moisture due to rain.
[4] The counter-trades, also known as "return trades", lie vertically over the trade winds and blow in the opposite direction. The term "anti-trades" has been applied both to the counter-trades and to the prevailing westerly winds of the middle latitudes.

73 Periodic winds
73.1 Monsoons
.2 Land and sea breezes. Land and lake breezes
.3 Mountain and valley breezes
Many winds of this class have been given individual local names; e. g., the *pontias*, *vésine* and *solore* of the French Alps; the *joran* of Lake Geneva; the *breva* and *tivano* of Lake Como.
74 Non-periodic winds
Föhn, sirocco, norther, mistral, bora, etc.
75 Cyclones, anticyclones, storms
75.1 Geographical distribution of storms in general
.2 Cyclones and anticyclones
.3 Tropical cyclones
Hurricane of the West Indies; *typhoon* of the China Sea; *baguio* of the Philippines.
.4 Thunderstorms and squalls
See also 85, Lightning.
.5 Spouts[6]
.6 Tornadoes
.7 Dust storms
80 Atmospheric electricity
81 Apparatus and methods
82 Geographical distribution
83 Ionisation, dissipation, conductivity
84 Potential
85 Lightning and lightning protection
See also 75.4, Thunderstorms
86 St Elmo's fire
87 Aurora
90 Climate and weather
91 Variations of climate
92 Climatography. Records of observations
Subdivided geographically.
93 Relation of climate and weather to geography and geology
94 Relation of climate and weather to plants
94.1 Phenology
.2 Agricultural
.3 Forest relations
See also 67.4, Relation of vegetation (forests, etc.) to water supply and stream flow.
95 Relation of climate and weather to animal life
Includes relations to various human activities, arts, industries, etc. *See also* 94.1, Phenology.
96 Mountain meteorology
97 Subterranean meteorology
98 Marine meteorology
99 Weather forecasting
99.1 Weather Warnings
Includes flags, whistles, lanterns, etc.
.2 Weather telegraphy
.3 Synoptic meteorology
.4 Weather types
5 Long-range forecasts
.6 Weather lore

[6] i. e., landspouts and waterspouts. A tornado is a violent landspout.

SECTION VII.—WEATHER AND DATA FOR THE MONTH.

THE WEATHER OF THE MONTH.

P. C. DAY, Climatologist and Chief of Division.

[Dated: Weather Bureau, Washington, Sept. 2, 1915.]

PRESSURE.

The distribution of the mean atmospheric pressure over the United States and Canada, and the prevailing directions of the winds are graphically shown on Chart VII, while the average values for the month at the several stations, with the departures from the normal, are shown in Tables I and III.

The mean atmospheric pressure for the month as a whole was below the normal over the greater portion of the country, but the minus departures were not especially marked over any district. From the central and northern Mississippi Valley eastward, and in the South Atlantic States, the minus departures ranged quite generally from 0.03 to 0.05 inch, and they were of similar magnitude over most of the Plateau region and north Pacific Coast States. In the lower Mississippi Valley, over most of the central Rocky Mountain region, and in California the means for the month were near the normal or slightly above, but in the Dakotas, Montana, and portions of Wyoming they were decidedly high, ranging from 0.04 to 0.07 inch above the normal.

At the beginning of the month low pressure obtained from the Plains region eastward to the Atlantic, and unsettled barometric conditions continued over eastern districts for several days, the pressure being especially low over the Canadian Provinces north of the Great Lakes on the 5th, and at the same time an extensive, though moderate, high area overspread the more southern districts. From the 7th to the 10th a well-defined disturbance moved from the central Plains region northeastward to the Canadian maritime Provinces, but it was not succeeded by a high pressure area worthy of note.

The second decade of the month was characterized by unsettled barometric conditions over eastern districts, with tendencies to relatively low readings in the interior and northern localities and relatively high to the southward. However, about the 18th a rather marked high area advanced from the Northwest, and during the following four or five days it overspread and dominated weather conditions over most districts to the eastward of the Rocky Mountains, and, as a rule, relatively high pressure continued during the remainder of the month.

TEMPERATURE.

The month opened with slowly rising temperature, which approximated the normal in most districts to eastward of the Rocky Mountains, but by the middle of the first week cooler weather prevailed in the northern mountain and central districts, while moderately warm weather obtained in the Gulf and Atlantic Coast States. During the latter part of the week the weather in the northwest became decidedly cooler, with minimum temperatures at points in Nebraska and Wyoming near or slightly below the freezing point and the coldest ever recorded at those points in July. The cool wave advanced into the Mississippi Valley and the interior districts to the eastward, establishing new records for low summer temperatures at many points. At the close of the week temperatures continued moderately low in the central valleys and eastern districts, and warmer weather was again in evidence in the West. The mean temperature for the week was almost universally below the normal, it being especially cold in the Missouri Valley and Plains States. However, in portions o the extreme South, along the Atlantic coast and in the far Northwest, the averages were near or slightly above the normal.

Temperatures near the normal prevailed in nearly all districts at the beginning of the second week and continued until after the middle, when decidedly cooler weather overspread the northern mountain and plateau regions; but in a few days temperatures had again risen to near the normal in all districts and at the close of the week they were generally near or slightly above the normal. The average temperature for the week was less than the normal over all central and northern districts, except near the extreme Upper Lakes and along the immediate Pacific coast, while in the Gulf and South Atlantic States and over the central and northern coasts of California, moderately warm weather prevailed.

During the first half of the third week warm weather prevailed over the districts from the Rocky Mountains eastward, but west of the mountains cooler weather set in early in the week and continued without much variation throughout. During the latter part of the week it remained warm over the Eastern and Southern States, but cooler weather overspread the northern districts from the Upper Lakes westward, and at the close it had extended to nearly all sections. The week as a whole was decidedly cool from the Upper Lake region westward to the central portions of Oregon and Washington, while high temperatures prevailed over practically all eastern and southern districts and along the immediate Pacific coast.

Decidedly cool midsummer weather prevailed over most districts east of the Rocky Mountains during the early part of the last 10-day period of the month, with a tendency to warmer weather as the decade advanced, and temperatures in all parts of the country were near the normal about the middle of the decade. However, during the next few days moderately cool weather prevailed along the northern border, and toward the latter part of the decade warmer weather overspread the central and eastern districts. The month closed with warm weather over eastern districts, generally cool weather in the Northwest, and normal July temperatures over nearly all other sections. For the decade as a whole, the average temperature was below the normal over large portions of the West and Northwest, while in the East and Southeast it was uniformly warm except in portions of New England and Florida, where it was below the normal.

PRECIPITATION.

During the first few days of the month substantial rains occurred quite generally east of the Appalachian Mountains. At the same time rain fell in the Middle West, and about the middle of the first week light to heavy showers occurred over much of the Gulf region and thence northward to the Canadian border, with some heavy rains in portions of New England. The week closed with fair weather over most central and eastern districts, but with light, local showers occurring in the

North Pacific States. The rainfall for the week was well distributed and generous over nearly all sections of the country from the Rocky Mountains eastward, but west of the mountains there was an absence of any material rainfall.

During the first few days of the second week thundershowers, with local heavy rains, prevailed over a considerable area from South Dakota, Nebraska, and northern Kansas eastward to Lake Michigan, and local storms of great severity occurred in portions of the Ohio Valley, causing the loss of a number of lives and much damage to property and crops. During the latter part of the week showers were fairly general from the Ohio Valley and lake regions eastward to the Middle Atlantic coast, and at the close of the week local showers occurred at widely separated points from the Florida Peninsula northwestward to Washington State. During the week much rainy weather prevailed from the middle Plains region eastward to the Ohio Valley and Lake Region and from Pennsylvania northeastward to New England, the precipitation being very generally well above the normal. Over the remaining districts to eastward of the Rocky Mountains the rainfall for the week was below the normal, practically no rain occurring in Texas. Over the districts west of the Rocky Mountains there was the usual absence of any material rains, except in the far Northwest where light local showers occurred.

During much of the third week rather frequent local showers occurred over the northern districts from the Rocky Mountains eastward and moderately dry weather prevailed in the South, but at the close of the week general showers, in some cases heavy, occurred over the Atlantic coast district and in portions of the Plains region. In Ohio local heavy rains fell, causing unusually high water in some of the rivers of that State with much damage to crops and other property, and the rivers in eastern Kansas and adjoining regions were high, due to heavy local rains. The rainfall for the week was unusually heavy in the central Plains States, but to the eastward of the Mississippi River the amounts were generally light, except heavy falls occurred in portions of Ohio, Indiana, the Florida Peninsula, and southeastern Louisiana. In much of the western portion of the cotton belt, and the central and southern portions of the plateau and Pacific coast districts the week was practically rainless.

Showery conditions prevailed over the Atlantic coast districts during the early part of the last decade of the month, but in most other districts the weather was clear, and toward the middle of the decade clear weather prevailed over nearly the entire country. During the latter part of the decade showers prevailed at intervals from the middle Plains region to the Great Lakes and thence eastward to the North Atlantic States, and at the close of the month thunderstorms occurred locally over wide areas, with some heavy precipitation in the upper Mississippi and lower Missouri valleys. The rainfall for the decade, as a whole, was light or entirely lacking over a large part of the country, the comparatively small amounts over much of the corn and wheat growing sections being in marked contrast to the previous heavy falls experienced during most of the season. Except for local areas in the Atlantic Coast States, the Missouri Valley, and thence eastward to the lake region, where an inch or more of rainfall occurred, and in the southern Rocky Mountains and plateau regions, where the falls were locally heavy, the precipitation during the decade was generally light, and no rain occurred over large areas in the central and west Gulf States, much of the great Central Valleys, and the Pacific Coast States.

GENERAL SUMMARY.

The outstanding features of the weather during July, 1915, were the continued marked low summer temperatures over much of the country, especially in the principal cereal-producing States, and the heavy to excessive rainfall from the central Plains region eastward. The close of the month marked a period of about 10 consecutive weeks in which the temperature remained continuously below the normal, save for a few brief intervals, over much of the interior and northern portions.

The mean temperature for the month was below the normal throughout the country, except in the South Atlantic and Gulf States and along the immediate Pacific coast, where the month was moderately warm. From the lake region and Ohio Valley westward to the central and northern plateau districts the minus departures ranged from 3° to 6°.

The rainfall for the month was heavy to excessive over many important sections, particularly so from the central Plains States eastward to the Ohio Valley, and thence northeastward over New York and New England, where from 6 to 15 inches were recorded. Excessive amounts were received also in limited areas in the South Atlantic and central Gulf States.

To the westward of the Rocky Mountains the usual summer distribution of rainfall occurred, except that the amounts were comparatively large in the southern portions of the mountain and plateau districts. and more than the normal amounts occurred from the Dakotas westward to the Pacific.

LOCAL STORMS DURING THE MONTH.

The following notes of severe storms have been extracted from reports of section directors:

Missouri.—Severe storms occurred in St. Charles County during the afternoon of July 7, four people being killed and 20 injured. Property loss probably exceeded $20,000.

Ohio.—One of the most destructive storms in the history of Cincinnati visited that city and the suburban districts in Clermont and Hamilton counties about 9.30 p. m., July 7. Many buildings were wrecked and several struck by lightning. Thirty-eight people were killed, 12 are missing and many were injured. Property loss about $1,500,000.

Kentucky.—On the 4th a severe local storm did considerable damage in Mercer County, and on the 7th heavy rainstorms, accompanied by winds of great violence, caused much damage. In Kenton and Campbell counties the property damage was estimated at $600,000, and 1 person was killed at Earlington.

Iowa.—During a typical tornado of small proportions that struck New London on the night of the 10th 1 person was killed, others were seriously injured, and much property destroyed. On the night of the 6th severe windstorms occurred near Logan and Garwin, and a press dispatch indicates that damage amounting to $100,000 was done to corn and oats near Storm Lake, on the 17th, by hail. The most damage was done, however, by excessive rains, accompanied by severe wind squalls, in the southwestern counties between the 11th and 14th, when corn and grain were beaten to the ground, rivers were out of their banks, and all low ground was flooded.

Georgia.—Severe local storms occurred on the 1st and 2d in the region between West Point, Columbus, and Macon, causing a great deal of damage to crops and destroying considerable of the peach crop by blowing the fruit from the trees.

Average and accumulated departures for July, 1915.

Districts.	Temperature.			Precipitation.			Cloudiness.		Relative humidity.	
	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure from the normal.	General mean for the current month.	Departure from the normal.
	°F.	°F.	°F.	In.	In.	In.	0—10.		P. ct.	
New England	67.4	−1.4	+ 7.3	5.87	+2.30	−2.20	6.0	+0.9	82	+ 2
Middle Atlantic	73.8	−0.8	+ 5.2	4.20	−0.10	−1.40	5.4	+0.5	75	+ 1
South Atlantic	79.8	+0.7	− 1.3	4.98	−1.10	−4.00	4.8	−0.4	77	− 3
Florida Peninsula[1]	83.0	+1.1	−10.4	5.15	−1.30	+2.50	5.8	+0.8	74	− 4
East Gulf	81.2	+0.9	− 3.0	4.00	−1.30	−3.70	4.0	−1.4	73	− 5
West Gulf	81.5	−0.4	− 5.4	1.49	−1.70	−1.80	3.3	−0.8	71	− 3
Ohio Valley and Tennessee	74.9	−1.9	− 3.5	4.25	+0.20	−5.20	5.3	+0.7	72	+ 3
Lower Lakes	69.4	−2.3	− 2.0	5.16	+1.80	−2.50	5.9	+1.4	77	+ 8
Upper Lakes	64.8	−3.2	+ 5.8	3.12	0.00	−2.30	5.7	+1.1	76	+ 4
North Dakota	63.0	−6.0	+11.3	2.38	−0.50	−0.30	5.0	+0.6	71	+ 5
Upper Mississippi Valley	71.6	−3.8	+ 1.4	6.24	+2.60	+3.40	6.2	+1.2	76	+ 8
Missouri Valley	71.2	−4.5	− 2.6	6.15	+2.30	+7.80	5.2	+1.0	76	+10
Northern slope	62.8	−5.3	+ 1.2	3.09	+1.50	+3.10	5.1	+1.4	66	+14
Middle slope	73.7	−3.1	− 7.1	2.87	−0.10	+5.10	4.6	+0.5	66	+ 6
Southern slope	79.8	−0.6	− 9.5	2.31	−0.50	+1.50	3.3	−1.2	59	0
Southern plateau	80.4	−1.4	−15.5	1.66	+0.40	+2.00	3.1	−0.2	46	+ 8
Middle plateau	72.1	−0.8	− 3.4	0.32	−0.20	0.00	2.7	−0.4	36	+ 4
Northern plateau	69.3	−1.6	+ 8.9	0.85	+0.40	+0.60	4.1	+1.4	45	+ 4
North Pacific	61.9	+0.7	+16.0	1.12	+0.40	−5.70	5.7	+1.1	76	+11
Middle Pacific	65.8	+0.3	+ 4.4	0.04	0.00	+4.70	2.6	−0.9	61	− 5
South Pacific	70.3	+0.4	+ 8.0	0.00	0.00	+3.90	2.4	−0.4	66	+ 2

[1] Regular Weather Bureau and selected cooperative stations.

Maximum wind velocities, July, 1915.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Mi/hr.				Mi/hr.	
Buffalo, N. Y.	5	60	sw.	Mount Tamalpais,			
Charlotte, N. C.	12	62	nw.	Cal.	28	54	nw.
Cheyenne, Wyo.	6	50	w.	Do.	29	54	nw.
Columbus, Ohio	15	52	w.	Do.	30	72	nw.
Drexel, Nebr.	18	68	se.	New York, N. Y.	8	55	n.
Eastport, Me.	9	51	ne.	Do.	17	77	nw.
El Paso, Tex.	5	50	sw.	Norfolk, Va.	29	65	ne.
Do.	11	54	nw.	Pensacola, Fla.	10	50	ne.
Do.	12	50	nw.	Point Reyes Light,			
Jacksonville, Fla.	20	52	w.	Cal.	6	52	nw.
Kansas City, Mo.	18	56	nw.	Do.	8	55	nw.
Lexington, Ky.	30	58	nw.	Do.	9	68	nw.
Lincoln, Nebr.	6	52	nw.	Do.	10	67	nw.
Do.	15	53	nw.	Do.	11	59	nw.
Modena, Utah	24	51	e.	Do.	13	72	nw.
Mount Tamalpais,				Do.	16	57	nw.
Cal.	5	52	nw.	Do.	26	65	nw.
Do.	6	67	nw.	Do.	27	63	nw.
Do.	7	56	nw.	Do.	28	56	nw.
Do.	8	62	nw.	Do.	29	51	nw.
Do.	12	52	nw.	Do.	30	60	nw.
Do.	16	71	nw.	Sandy Hook, N. J.	8	54	n.
Do.	26	54	nw.	Savannah, Ga.	1	50	nw.
Do.	27	52	nw.	Do.	6	52	w.

CONDENSED CLIMATOLOGICAL SUMMARY.

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data, as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course the number of such records is smaller than the total number of stations.

Summary of temperature and precipitation, by sections, July, 1915.

Section.	Temperature.								Precipitation.					
			Monthly extremes.								Greatest monthly.		Least monthly.	
	Section average.	Departure from the normal.	Station.	Highest.	Date.	Station.	Lowest.	Date.	Section average.	Departure from the normal.	Station.	Amount.	Station.	Amount.
	°F.	°F.		°F.			°F.		Ins.	Ins.		Ins.		Ins.
Alabama	80.4	+0.3	2 stations	105	31	Florence	52	6	5.23	+0.11	Healing Springs	10.96	Uniontown	0.75
Arizona	79.6	−0.6	Sentinel	116	1	Alpine	29	7	2.71	+0.56	Mutrioso	7.72	Gila Bend	0.21
Arkansas	77.1	−1.8	Hemp Wallace	107	30	Dutton	43	5	2.40	−1.74	Emerson	9.79	2 stations	0.32
California	72.7	−1.3	Greenland ranch	120	20	2 stations	29	5†	0.06	+0.02	Crescent City	1.30	176 stations	0.00
Colorado	64.2	−2.0	Platte Canyon	103	11	Cortez	22	21	1.66	−0.36	Julesburg	5.35	Nast	0.00
Florida	82.2	+1.0	3 stations	102	18†	Fenholloway	60	27	7.26	−0.42	Titusville	14.71	Sand Key	1.37
Georgia	80.8	+0.7	2 stations	106	31	Blue Ridge	52	6†	4.25	−1.27	West Point	15.49	Augusta	1.63
Hawaii (May) *	73.1	.....	Waialua Mill	92	30	Volcano House	48	31	2.70	.....	Lumber Mill (Pahoa)	15.80	Waiawa, Kauai	0.00
Hawaii (June)	73.4	.....	Waianae, Oahu	93	12	Volcano House	49	1†	5.45	.....	Keanae, Maui	20.95	Waiopae Ranch	0.00
Idaho	65.1	−2.5	Glenns Ferry	110	22	Pierson	23	20	1.34	+0.42	Castle Creek	4.99	Wendell	0.13
Illinois	72.8	−3.1	Equality	101	31	3 stations	41	3	6.70	+3.16	Manteno	12.92	New Burnside	1.88
Indiana	72.7	−2.7	Rome	100	30	Auburn	44	6	6.34	+2.67	Monticello	12.51	Madison	2.49
Iowa	69.5	−4.6	9 stations	92	13†	Washta	40	5	8.34	+4.38	Corning	15.83	Spencer	3.68
Kansas	74.0	−3.7	Santa Fe	105	12	St. Francis	41	4	6.06	+2.15	Manhattan	12.38	Liberal	2.07
Kentucky	75.7	−1.1	Earlington	102	30†	2 stations	49	6	5.30	+0.95	Richmond	10.10	Hopkinsville	1.30
Louisiana	82.3	+0.5	Angola	107	17†	Robeline	53	23	5.75	−0.47	Pearl River	12.66	Vinton	1.11
Maryland and Delaware	74.5	−1.1	Cambridge, Md.	103	17	Deer Park, Md.	36	9	3.27	−1.02	Salisbury, Md.	6.10	Annapolis, Md	1.29
Michigan	65.9	−2.6	Allegan	94	13†	Watersmeet	28	25	3.65	+0.52	Cassopolis	8.43	St. James	0.73
Minnesota	64.6	−4.4	Moose Lake	96	13	Cloquet	30	25	3.89	+0.49	Grand Meadow	7.63	Two Harbors	0.45
Mississippi	80.8	+0.1	Austin	105	29	3 stations	53	6†	3.83	−1.22	McNeill	7.45	Rosedale	1.20
Missouri	74.6	−2.4	Hollister	102	29†	Cassville	42	6	6.05	+1.59	Maryville	20.22	Houston	0.58
Montana	60.1	−4.8	4 stations	97	21†	Brenner	20	18	3.71	+2.24	Pinegrove	7.45	Libby	1.09
Nebraska	69.4	−4.9	Bridgeport	103	17	Gordon	31	4	6.01	+2.47	Westpoint	12.81	Kimball	1.07
Nevada	70.8	−1.5	Caliente	110	13†	Potts	31	31	0.38	−0.08	Sharp	3.50	6 stations	0.00
New England	67.8	−1.5	2 stations	94	17†	Presque Isle, Me.	37	10	7.49	+3.76	Lawrence, Mass.	12.72	Nantucket, Mass.	1.32
New Jersey	72.8	−1.0	Tuckerton	98	17	Charlotteburg	44	7	5.31	+0.49	Hightstown	11.06	Tuckerton	2.23
New Mexico	71.8	−0.9	Artesia	110	11	Elizabethtown	27	7†	3.70	+1.04	Lake Alice (near)	10.55	Roswell	0.45
New York	68.0	−1.6	West Berne	95	31	Wanakena	35	23	6.30	+2.31	Greene	12.65	Mount Vernon	1.96
North Carolina	77.6	+0.2	4 stations	103	17†	Banners Elk	42	6	4.36	−1.68	Southport	11.15	Pinehurst	1.14
North Dakota	61.1	−6.5	2 stations	97	11†	2 stations	30	4†	3.01	+0.34	Bowman	7.55	Maddock	0.67
Ohio	71.5	−2.1	Jackson	99	31	2 stations	43	8†	6.32	+2.52	Lima (1)	11.23	Clarington	3.45
Oklahoma	78.5	−2.1	Mutual	104	28	Goodwell	41	5	2.92	−0.33	Hammon	5.85	Heavener	0.07
Oregon	65.3	−0.2	Umatilla	109	21	2 stations	18	14†	1.29	+0.83	Headworks	4.10	Grass Valley	0.00
Pennsylvania	70.7	−1.4	2 stations	98	19†	2 stations	40	9†	5.28	−0.97	Lawrenceville	12.30	McCall Ferry	1.82
Porto Rico	79.6	+0.8	Juana Diaz	99	5†	Maricao	55	5†	7.26	+0.88	Rio Grande (El Verde).	25.92	Guanica Centrale	1.34
South Carolina	80.9	+0.9	Meriwether	106	31	2 stations	55	22†	3.32	−2.19	Beaufort	7.42	Mayesville (near)	1.07
South Dakota	65.3	−5.7	Wood	96	13	Wood	28	5	5.89	+2.88	Marion	9.47	Mooridge	1.62
Tennessee	77.0	−0.1	3 stations	103	30†	Erasmus	42	6	4.36	−0.36	Tazewell	7.96	Pinewood	0.72
Texas	82.5	0.0	2 stations	109	16†	Tahoka	48	5	2.07	−0.92	Stowell	8.30	7 stations	0.00
Utah	69.7	−1.3	Woodside	110	5†	Scofield	27	31	0.39	−0.37	Alton	2.21	7 stations	0.00
Virginia	74.6	−0.6	Diamond Springs	101	16	Hot Springs	35	4†	4.04	−0.61	Eastville	8.25	Dry Bridge	1.31
Washington	65.7	0.0	Eltopia	110	23	2 stations	32	11	1.40	+0.42	Irene Mountain	7.15	Eltopia	0.00
West Virginia	71.9	−1.5	Romney	99	19	Philippi	38	9	4.63	−0.03	Cairo	11.31	Upper Tract	1.82
Wisconsin	65.2	−4.0	Osceola	95	12†	Long Lake	29	25	3.94	+0.09	Florence	6.85	Port Washington	0.79
Wyoming	59.8	−3.4	2 stations	96	21†	Daniel	18	18	1.89	+0.36	Gillette	7.69	Green River	0.10

* Late report.

† Other dates also.

DESCRIPTION OF TABLES AND CHARTS.

Table I gives the data ordinarily needed for climatological studies for about 158 Weather Bureau stations making simultaneous observations at 8 a. m. and 8 p. m., daily, seventy-fifth meridian time, and for about 41 others making only one observation. The altitudes of the instruments above ground are also given.

Table II gives a record of precipitation, the intensity of which at some period of the storm's continuance equaled or exceeded the following rates:

Duration (minutes)	5	10	15	20	25	30	35	40	45	50	60
Rates per hour (inches)	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.87	0.84	0.80

It is impracticable to make this table sufficiently wide to accommodate on one line the record of accumulated falls that continue at an excessive rate for several hours. In this case *the record is broken at the end of each 50 minutes*, the accumulated amounts being recorded on successive lines until the excessive rate ends.

In cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest precipitation of any single storm has been given, also the greatest hourly fall during that storm.

The tipping-bucket mechanism is *dismounted* and removed when there is danger of snow or water freezing in the same. Table II records this condition by entering an asterisk (*).

Table III gives, for about 30 stations of the Canadian Meteorological Service, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values except in the case of snowfall.

Chart I.—Hydrographs for several of the principal rivers of the United States.

Chart II.—Tracks of centers of high areas; and

Chart III.—Tracks of centers of low areas. The roman numerals show the chronological order of the centers. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the observations at 8 a. m. and 8 p. m., seventy-fifth meridian time. Within each circle is also given (Chart II) the last three figures of the highest barometric reading and (Chart III) the lowest reading reported at or near the center at that time, and in both cases as reduced to sea level and standard gravity.

Chart IV.—Temperature departures. This chart presents the departures of the monthly mean temperatures from the monthly normals. The normals used in computing the departures were computed for a period of 33 years (1873 to 1905) and are published in Weather Bureau Bulletin "R," Washington, 1908. Stations whose records were too short to justify the preparation of normals in 1908 have been provided with normals as adequate records became available, and all have been reduced to the 33-year interval 1873–1905. The shaded portions of the chart indicate areas of positive departures and unshaded portions indicate areas of negative departures. Generalized lines connect places having approximately equal departures of like sign. This chart of monthly temperature departures in the United States was first published in the MONTHLY WEATHER REVIEW for July, 1909.

Chart V.—Total precipitation. The scale of shades showing the depth is given on the chart. Where the monthly amounts are too small to justify shading, and over sections of the country where stations are too widely separated or the topography is too diversified to warrant reasonable accuracy in shading, the actual depths are given for a limited number of representative stations. Amounts less than 0.005 inch are indicated by the letter T, and no precipitation by 0.

Chart VI.—Percentage of clear sky between sunrise and sunset. The average cloudiness at each Weather Bureau station is determined by numerous personal observations between sunrise and sunset. The difference between the observed cloudiness and 100 is assumed to represent the percentage of clear sky, and the values thus obtained are the basis of this chart. The chart does not relate to the nighttime.

Chart VII.—Isobars and isotherms at sea level and prevailing wind directions. The pressures have been reduced to sea level and standard gravity by the method described by Prof. Frank H. Bigelow on pages 13–16 of the REVIEW for January, 1902. The pressures have also been reduced to the mean of the 24 hours by the application of a suitable correction to the mean of the 8 a. m. and 8 p. m. readings at stations taking two observations daily, and to the 8 a. m. or the 8 p. m. observation, respectively, at stations taking but a single observation. The diurnal corrections so applied will be found in the Annual Report of the Chief of the Weather Bureau, 1900–1901, volume 2, Table 27, pages 140–164.

The isotherms on the sea-level plane have been constructed by means of the data summarized in chapter 8 of volume 2 of the annual report just mentioned. The correction t_0-t, or temperature on the sea-level plane minus the station temperature as given by Table 48 of that report, is added to the observed surface temperature to obtain the adopted sea-level temperature.

The prevailing wind directions are determined from hourly observations at the great majority of the stations; a few stations having no self-recording wind-direction apparatus determine the prevailing direction from the daily or twice-daily observations only.

Chart VIII.—Total snowfall. This is based on the reports from regular and cooperative observers and shows the depth in inches and tenths of the snowfall during the month. In general, the depth is shown by lines inclosing areas of equal snowfall, but in special cases figures are also given. Chart VIII is published only when the general snow cover is sufficiently extensive to justify its preparation.

[Charts XLIII–71 to XLIII–83 illustrate the article, by W. H. Alexander, pp. 322–340.]

TABLE I.—*Climatological data for United States Weather Bureau stations, July, 1915.*

Districts and stations.	Elevation of instruments.			Pressure.			Temperature of the air.										Mean wet thermometer.	Mean temperature of the dew point.	Mean relative humidity.	Precipitation.			Wind.						Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness.	Total snowfall.	Snow on ground at end of month.
	Barometer above sea level.	Thermometer above ground.	Anemometer above ground.	Station, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean max.+mean min.÷2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with 0.01 or more.	Total movement.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.							
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F*		°*F*	°*F.*		°*F*	°*F.*	°*F.*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles.*									*0–10*		
New England.							**67.4**	**— 1.4**											**82**	**5.87**	**+ 2.3**										**6.0**		
Eastport	76	67	85	29.84	29.92	—0.01	58.1	— 1.7	80	18	66	46	6	50	31	53	50	79		3.75	+ 0.3	12	4,958	s.	51	ne.	9	7	10	14	6.4	.....	.....
Greenville	1,070	6	....	28.78	29.92	.....	63.6	.....	82	25	74	45	6	54	33	.....	.....	.....		8.98	.....	17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portland, Me.	103	82	117	29.82	29.94	— .01	64.4	— 3.6	81	13	71	53	9	58	24	60	57	80		10.84	+ 7.6	17	5,361	e.	38	nw.	9	8	10	13	6.3	.....	.....
Concord	288	70	79	29.62	29.92	— .04	68.2	— 0.9	89	13	78	49	7	58	33	.....	.....	.....		10.29	+ 6.5	16	3,324	se.	21	nw.	9	6	14	11	5.9	.....	.....
Burlington	404	11	48	29.48	29.90	— .04	67.6	— 0.6	87	31	76	50	21	59	27	.....	.....	.....		5.46	+ 1.7	15	5,645	s.	31	s.	5	6	15	10	5.9	.....	.....
Northfield	876	12	60	29.00	29.93	— .01	64.6	— 2.0	86	31	76	45	7	54	33	60	58	82		5.22	+ 1.5	18	3,793	s.	21	s.	5	2	15	14	6.8	.....	.....
Boston	125	115	188	29.79	29.92	— .04	70.1	— 1.2	90	13	77	58	25	63	27	64	61	79		8.85	+ 5.5	15	5,995	e.	33	nw.	9	8	14	9	5.2	.....	.....
Nantucket	12	14	90	29.92	29.93	— .05	66.8	— 0.7	83	30	73	55	26	60	18	63	62	90		1.32	— 1.4	9	9,674	sw.	36	s.	8	5	16	10	5.6	.....	.....
Block Island	26	11	46	29.89	29.92	— .05	68.3	+ 0.2	82	31	74	59	26	63	16	65	64	91		1.59	— 1.7	9	9,436	sw.	36	nw.	9	6	12	13	6.4	.....	.....
Narragansett Pier	....	9	....	.....	.....	.....	67.8	— 2.1	85	19	75	50	7	61	26	.....	.....	.....		2.02	.....	12	.....	sw.	.....	.....	.....	16	8	7	.....	.....	.....
Providence	160	215	251	29.75	29.92	— .05	70.1	— 3.3	89	17	78	54	25	62	26	64	61	77		6.35	+ 2.8	14	7,540	s.	40	nw.	5	8	16	7	5.8	.....	.....
Hartford	159	122	140	29.75	29.92	— .05	71.7	+ 0.1	89	17	81	55	23	62	29	65	61	76		6.97	+ 2.9	16	4,784	s.	37	ne.	14	4	19	8	5.9	.....	.....
New Haven	106	117	155	29.81	29.92	— .05	71.4	— 0.5	91	17	80	55	25	63	25	66	64	80		3.90	— 0.9	14	5,426	s.	27	nw.	8	6	13	12	6.2	.....	.....
Middle Atlantic States.							**73.8**	**— 0.8**											**75**	**4.20**	**— 0.1**										**5.4**		
Albany	97	102	115	29.81	29.91	— .05	71.4	— 0.6	91	31	80	53	7	62	29	64	61	74		5.05	+ 1.2	14	4,567	s.	32	n.	8	13	13	5	4.6	.....	.....
Binghamton	871	10	69	29.01	29.92	— .05	68.9	— 1.0	87	31	79	50	22	59	30	.....	.....	.....		8.13	+ 4.6	17	2,806	nw.	24	w.	3	2	16	13	6.5	.....	.....
New York	314	414	454	29.60	29.93	— .05	72.5	— 1.0	92	31	80	59	9	65	23	65	61	73		4.60	+ 0.1	15	9,184	sw.	77	nw.	17	6	10	15	6.8	.....	.....
Harrisburg	374	94	104	29.55	29.94	— .04	74.2	— 0.3	93	19	83	57	22	65	25	66	62	69		4.03	+ 0.2	13	3,837	w.	33	n.	8	6	18	7	5.7	.....	.....
Philadelphia	117	123	190	29.82	29.94	— .04	76.0	+ 0.2	93	17	84	61	25	68	22	69	66	74		5.02	+ 0.7	16	6,310	nw.	38	n.	13	7	16	8	5.4	.....	.....
Reading	325	81	98	29.60	29.94	.....	74.0	.....	93	19	84	57	7	65	27	66	62	70		4.56	+ 0.3	15	4,175	se.	24	n.	8	4	8	19	6.7	.....	.....
Scranton	805	111	119	29.10	29.95	— .03	70.4	— 1.4	89	30	80	51	10	61	29	64	61	74		2.60	— 1.2	15	4,064	sw.	31	sw.	8	4	15	12	6.7	.....	.....
Atlantic City	52	37	48	29.89	29.94	— .04	72.6	+ 0.1	93	31	79	58	9	66	26	68	66	82		2.37	— 1.4	15	4,977	sw.	23	sw.	8	8	10	13	5.9	.....	.....
Cape May	18	13	49	29.95	29.97	— .01	72.8	— 0.6	92	31	79	60	25	66	21	.....	.....	.....		4.11	+ 0.3	16	4,885	s.	32	nw.	17	9	18	4	4.9	.....	.....
Sandy Hook	22	10	57	29.91	29.93	.....	72.9	.....	91	31	80	61	26	66	21	68	67	88		3.46	.....	16	8,358	s.	54	n.	8	7	17	7	5.2	.....	.....
Trenton	190	159	183	29.73	29.92	.....	73.7	.....	92	30	83	57	25	65	27	66	63	75		7.20	+ 2.4	16	6,619	w.	46	sw.	19	7	14	10	6.2	.....	.....
Baltimore	123	100	113	29.81	29.94	— .06	76.9	— 0.4	95	31	85	61	22	69	25	69	65	69		2.22	— 2.6	11	4,739	sw.	26	n.	8	9	16	6	4.9	.....	.....
Washington	112	62	85	29.82	29.94	— .06	76.1	— 0.7	95	31	86	58	25	66	28	68	65	72		3.21	— 1.4	13	3,868	nw.	49	nw.	16	6	15	10	5.5	.....	.....
Lynchburg	681	153	188	29.23	29.95	— .06	76.2	— 1.1	95	31	87	54	6	65	31	68	65	73		3.05	— 1.0	12	4,311	w.	36	nw.	29	6	22	3	5.1	.....	.....
Norfolk	91	170	205	29.87	29.96	— .04	77.4	— 1.0	96	16	85	63	10	70	24	70	67	75		5.72	— 0.1	11	8,505	sw.	65	ne.	29	11	12	8	4.8	.....	.....
Richmond	144	11	52	29.82	29.96	— .05	78.0	— 1.2	99	16	88	60	6	68	28	69	66	72		2.42	— 2.0	7	5,174	sw.	35	nw.	17	9	18	4	4.5	.....	.....
Wytheville	2,293	40	47	27.67	29.97	— .04	70.2	— 2.4	91	31	81	49	6	59	31	64	62	80		2.88	— 1.6	15	2,923	w.	23	w.	8	18	11	2	3.2	.....	.....
South Atlantic States.							**79.8**	**+ 0.7**											**77**	**4.98**	**— 1.1**										**4.8**		
Asheville	2,255	70	84	27.72	29.99	— .03	72.0	+ 0.3	92	31	83	52	6	62	27	65	63	79		2.78	— 2.1	14	3,848	nw.	25	w.	19	10	16	5	4.7	.....	.....
Charlotte	773	153	161	29.16	29.97	— .05	79.4	+ 0.7	100	31	89	62	23	69	25	69	66	70		3.08	— 2.4	9	6,504	sw.	62	nw.	12	8	16	7	5.3	.....	.....
Hatteras	11	12	50	29.96	29.97	— .04	77.8	— 0.8	89	14	83	68	27	73	16	74	73	87		4.75	— 1.4	14	9,751	sw.	40	nw.	20	10	11	10	6.0	.....	.....
Manteo	12	4	46	.....	.....	.....	77.8	.....	96	16	86	55	10	70	.....	.....	.....	.....		9.58	+ 3.5	8	.....	sw.	.....	.....	.....	15	8	8	.....	.....	.....
Raleigh	376	103	110	29.58	29.96	— .06	79.6	+ 1.1	98	15	89	61	26	70	29	70	66	71		2.83	— 3.3	12	5,374	sw.	33	nw.	8	12	14	5	4.5	.....	.....
Wilmington	78	81	91	29.90	29.98	— .03	79.5	+ 0.8	95	13	88	65	10	72	25	74	72	82		8.12	+ 1.2	14	5,473	sw.	35	w.	19	11	15	5	4.9	.....	.....
Charleston	48	11	92	29.94	29.99	— .04	82.2	+ 0.9	97	13	89	70	27	75	21	76	74	79		2.98	— 4.3	10	6,933	s.	38	w.	9	11	14	6	4.5	.....	.....
Columbia, S. C.	351	41	57	29.61	29.98	— .04	81.3	+ 0.2	100	18	92	64	25	71	27	72	68	70		2.31	— 3.8	8	4,739	sw.	25	w.	20	17	12	2	3.0	.....	.....
Augusta	180	89	97	29.79	29.98	— .04	82.0	+ 1.5	98	18	92	65	26	72	27	73	69	69		1.63	— 3.7	9	4,158	ne.	28	w.	19	15	12	4	4.3	.....	.....
Savannah	65	150	194	29.92	29.99	— .04	82.0	+ 1.5	98	18	91	67	25	73	24	75	73	82		7.40	+ 1.2	15	7,269	sw.	52	w.	6	10	13	8	4.9	.....	.....
Jacksonville	43	209	245	29.96	30.01	— .02	81.8	+ 0.9	98	18	90	69	10	74	25	75	73	82		9.36	+ 3.2	16	8,186	sw.	52	w.	20	9	16	6	5.4	.....	.....
Florida Peninsula.							**83.0**	**+ 1.1**											**74**	**5.15**	**— 1.3**										**5.8**		
Key West	22	10	64	29.98	30.00	— .33	84.4	+ 0.7	92	20	90	72	22	79	18	76	74	71		3.84	+ 0.2	14	5,611	se.	40	w.	22	6	21	4	5.4	.....	.....
Miami	25	71	79	30.00	30.03	.....	81.9	0.0	91	17	87	72	25	77	15	76	74	76		6.54	— 0.7	15	4,980	se.	25	se.	28	3	13	15	6.8	.....	.....
Sand Key	23	39	72	29.96	29.99	— .04	83.8	.....	91	21	87	73	23	81	15	77	75	74		1.37	.....	6	7,032	se.	36	w.	23	10	19	2	4.7	.....	.....
Tampa	35	79	96	29.98	30.01	— .03	82.6	+ 2.6	93	16	90	72	24	75	20	75	73	76		5.08	— 3.4	14	4,205	se.	25	ne.	25	1	23	7	6.2	.....	.....
East Gulf States.							**81.2**	**+ 0.9**											**73**	**4.06**	**— 1.3**										**4.0**		
Atlanta	1,174	190	216	28.81	30.02	— .00	78.6	+ 1.0	97	31	88	61	6	70	23	70	66	69		3.22	— 1.5	8	6,378	nw.	36	nw.	20	18	5	8	4.4	.....	.....
Macon	370	78	87	29.60	29.98	— .04	81.8	+ 2.1	100	18	92	64	22	71	27	72	68	67		1.88	— 2.8	7	3,848	s.	44	w.	1	9	17	5	4.5	.....	.....
Thomasville	273	8	57	29.71	30.00	— .03	82.6	+ 0.8	100	18	94	63	26	71	32	74	72	80		4.68	— 0.6	12	3,224	sw.	32	sw.	19	11	15	5	4.6	.....	.....
Pensacola	56	140	182	29.94	30.00	— .01	81.8	+ 0.4	94	18	88	68	23	75	22	75	72	77		3.41	— 3.9	12	7,846	sw.	50	ne.	10	11	14	6	5.0	.....	.....
Anniston	741	9	57	29.24	30.02	.00	78.3	+ 0.4	99	31	90	58	22	67	30	.....	.....	.....		3.88	— 0.8	11	2,985	s.	26	nw.	19	19	9	3	2.8	.....	.....
Birmingham	700	11	48	29.27	30.02	+ .01	79.4	— 2.1	99	31	89	59	6	70	26	71	67	72		5.72	+ 1.0	8	3,691	s.	24	nw.	1	13	11	7	4.7	.....	.....
Mobile	57	125	161	29.94	30.00	— .01	82.9	+ 2.4	97	28	91	67	22	75	22	75	72	75		5.82	— 1.2	9	6,278	sw.	35	nw.	16	12	17	2	4.0	.....	.....
Montgomery	223	100	112	29.76	30.00	— .02	81.8	+ 0.8	98	18	92	65	22	72	25	73	69	70		4.73	0.0	7	4,191	sw.	31	se.	17	18	9	4	3.2	.....	.....
Meridian	375	85	93	29.61	29.99	— .03	80.6	+ 0.6	98	28	90	60	23	71	29	72	69	71		1.71	— 2.8	5	3,336	sw.	24	sw.	4	15	13	3	4.0	.....	.....
Vicksburg	247	65	74	29.74	30.01	+ .01	80.8	+ 0.4	95	30	89	62	22	73	23	73	71	77		1.44	— 3.0	7	4,202	sw.	27	sw.	1	19	8	4	3.5	.....	.....
New Orleans	51	76	84	29.94	29.99	— .01	84.7	+ 3.4	100	28	93	69	3	76	27	75	72	72		7.55	+ 1.1	9	3,927	sw.	35	nw.	3	17	11	3	3.6	.....	.....
West Gulf States.							**81.5**	**— 0.4**											**71**	**1.49**	**— 1.7**										**3.3**		
Shreveport	249	77	93	29.73	29.99	+ .01	81.4	— 0.7	99	29	90	64	22	72	26	72	68	70		2.44	— 1.3	4	4,684	s.	24	nw.	2	24	1	6	3.0	.....	.....
Bentonville	1,303	11	44	28.63	29.97	.00	74.8	— 3.7	93	30	85	49	5	64	28	.....	.....	.....		1.68	— 2.6	8	3,546	s.	21	s.	10	18	11	2	3.3	.....	.....
Fort Smith	457	79	94	29.48	29.95	— .02	79.6	— 1.4	100	29	90	57	5	69	28	70	66	66		1.08	— 2.8	5	4,817	e.	31	sw.	7	20	6	5	3.1	.....	.....
Little Rock	357	139	147	29.61	29.97	— .02	80.0	— 0.6	100	30	89	60	5	71	26	72	69	74		0.96	— 3.0	4	5,826	sw.	38	w.	8	18	7	6	3.6	.....	.....
Brownsville	57	3	40	.....	.....	.....	85.0	.....	98	29	94	64	25	76	30	.....	.....	.....		0.15	.....	2	.....	se.	28	.....	.....	10	.....	.....	.....	.....	.....
Corpus Christi	20	69	77	29.93	29.95	— .01	82.8	+ 0.1	92	21	87	73	23	78	16	77	75	82		0.03	— 1.6	2	13,072	se.	42	se.	7	17	11	3	3.7	.....	.....
Dallas	512	109	117	29.42	29.96	.....	82.2	.....	98	29	92	59	5	72	26	.....	.....	.....		0.12	.....	2	7,861	se.	30	n.	4	18	9	4	3.3	.....	.....
Fort Worth	670	106	114	29.23	29.93	— .03	81.9	— 1.8	98	29	92	60	5	72	27	69	63	58		0.30	— 2.7	2	8,359	s.	28	sw.	7	16	12	3	3.6	.....	.....
Galveston	54	106	114	29.94	30.00	+ .02	83.0	0.0	91	20	87	70	4	79	14	76	73	75		2.45	— 1.5	6	8,335	s.	35	n.	20	23	5	3	2.5	.....	.....
Houston	138	111	121	29.83	29.97	.....	83.6	+ 0.6	99	17	93	67	25	74	26	.....	.....	.....		2.92	.....	5	5,866	s.	32	se.	26	20	9	2	3.1	.....	.....
Palestine	510	64	72	29.44	29.96	— .01	81.6	+ 0.1	95	29	91	63	23	72	27	74	71	76		3.91	+ 0.9	3	5,512	s.	24	nw.	20	18	9	4	3.9	.....	.....
San Antonio	701	109	132	29.22	29.92	— .03	84.8	+ 2.4	101	1	96	67	24	74	27	72	67	64		0.92	— 1.3	2	7,399	s.	34	s.	3	24	7	0	2.9	.....	.....
Taylor	582	55	63	29.38	29.99	+ .03	83.3	+ 0.6	98	20	94	65	24	73	27	.....	.....	.....		1.17	— 1.4	4	7,883	s.	27	s.	7	12	17	2	3.8	.....	.....

TABLE I.—*Climatological data for United States Weather Bureau stations, July, 1915*—Continued.

Districts and stations.	Elevation of instruments.			Pressure.			Temperature of the air.											Mean wet thermometer.	Mean temperature of the dew point.	Mean relative humidity.	Precipitation.			Wind.									Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness.	Total snowfall.	Snow on ground at end of month.
	Barometer above sea level.	Thermometer above ground.	Anemometer above ground.	Station, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean max.+mean min.÷2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.						Total.	Departure from normal.	Days with 0.01 or more.	Total movement.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.							
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F*		°*F*	°*F.*		°*F*	°*F.*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles.*											*0–10*		
Ohio Valley and Tennessee.							**74.9**	**− 1.9**										**72**	**4.25**	**+ 0.2**													**5.3**		
Chattanooga	762	189	213	29.21	30.00	−0.02	78.2	+ 0.4	97	31	88	57	6	69	26	70	66	72	5.20	+ 1.3	11	4,611	sw.	34	sw.	1	12	11	8	5.0		
Knoxville	996	93	100	28.96	29.99	− .03	76.8	+ 0.6	99	31	86	56	6	67	26	69	66	74	3.72	− 0.5	15	3,315	sw.	26	n.	17	9	13	9	5.5		
Memphis	399	76	97	29.59	30.01	+ .01	79.8	− 0.9	97	30	88	62	5	72	24	72	68	71	1.16	− 2.4	7	5,890	sw.	46	n.	17	15	11	5	3.8		
Nashville	546	168	191	29.43	30.00	− .01	78.6	− 0.8	99	31	89	56	6	68	28	69	65	67	2.03	− 2.3	11	5,407	sw.	36	sw.	8	13	15	3	4.2		
Lexington	989	193	230	28.93	29.97	− .04	74.5	− 2.1	93	31	83	55	5	66	22	.....	.....	.....	5.72	+ 1.3	12	6,391	sw.	58	nw.	30	11	17	3	4.5		
Louisville	525	219	255	29.41	29.98	− .02	76.1	− 2.5	97	31	86	56	5	67	24	68	64	70	3.73	0.0	12	6,801	sw.	48	nw.	10	7	14	10	5.5		
Evansville	431	72	82	29.51	29.96	− .04	77.0	− 2.3	96	31	86	57	5	68	22	69	66	73	2.92	− 0.9	12	4,209	sw.	33	s.	7	8	15	8	5.4		
Indianapolis	822	194	230	29.09	29.96	− .03	73.0	− 3.2	91	15	82	52	5	64	24	65	62	73	7.94	+ 3.8	14	6,213	sw.	44	n.	20	5	12	14	6.0		
Terre Haute	575	96	129	29.34	29.94	.....	74.1	.....	93	16	83	53	5	65	24	68	65	78	7.87	.....	17	5,389	sw.	42	w.	2	1	22	8	6.5		
Cincinnati	628	11	51	29.29	29.96	− .04	73.5	− 4.2	95	31	84	54	22	64	28	67	64	74	4.93	+ 1.4	14	2,992	sw.	44	nw.	7	12	10	9	5.2		
Columbus	824	173	222	29.10	29.96	− .04	73.0	− 2.3	93	16	82	55	5	64	26	66	63	75	6.85	+ 3.2	15	5,875	s.	52	w.	15	14	13	4	4.3		
Dayton	899	181	216	29.01	29.94	.....	72.8	− 3.4	92	16	82	54	5	64	26	66	63	75	4.34	+ 1.1	13	5,355	sw.	35	n.	16	12	13	6	4.6		
Pittsburgh	842	353	410	29.07	29.95	− .05	72.0	− 2.6	89	31	80	54	9	64	26	64	60	69	3.37	− 1.0	13	6,242	nw.	39	n.	8	7	10	14	6.1		
Elkins	1,940	41	50	27.99	29.98	− .03	69.0	− 1.5	91	31	81	46	9	58	35	63	60	82	3.40	− 1.2	19	2,291	w.	15	sw.	11	3	13	15	7.1		
Parkersburg	638	77	84	29.34	29.99	− .02	73.7	− 1.9	94	31	84	55	6	64	27	66	63	75	4.21	− 0.4	17	3,290	se.	34	n.	31	9	15	7	5.6		
Lower Lake Region.							**69.4**	**−2.3**										**77**	**5.16**	**+1.6**													**5.9**		
Buffalo	767	247	280	29.12	29.93	−0.4	67.8	−2.4	84	10	74	51	6	62	23	63	60	79	3.37	0.0	16	8,680	sw.	60	sw.	5	6	13	12	6.1		
Canton	448	10	61	29.44	29.91	.....	67.2	−3.3	87	16	77	49	21	57	31	.....	.....	.....	5.92	+2.7	15	5,582	sw.	44	w.	5	18	6	7	4.1		
Oswego	335	76	91	29.56	29.92	−0.4	67.1	−2.5	82	16	74	53	6	60	23	62	59	78	3.63	+0.4	12	5,133	w.	39	nw.	3	7	13	11	5.6		
Rochester	523	97	113	29.38	29.94	−0.3	69.0	−1.4	85	14	78	52	6	60	26	62	59	74	2.68	−0.4	9	4,713	sw.	36	sw.	5	6	13	12	6.2		
Syracuse	597	97	113	29.31	29.95	−0.2	68.9	−1.9	84	31	77	53	22	61	25	64	62	83	7.37	+3.7	14	5,981	s.	31	ne.	2	6	13	12	6.3		
Erie	714	130	166	29.18	29.93	−0.5	69.3	−2.5	86	16	76	56	4	63	24	64	62	77	5.14	+1.9	16	7,664	s.	43	sw.	5	9	11	11	5.8		
Cleveland	762	190	201	29.14	29.95	−0.4	69.8	−2.7	89	16	76	55	23	64	22	64	61	75	4.73	+1.2	14	7,051	s.	42	ne.	8	4	15	12	6.1		
Sandusky	629	62	103	29.28	29.94	−0.5	71.0	−2.6	92	16	78	53	6	64	25	65	62	77	6.19	+2.4	16	6,674	sw.	31	sw.	15	8	11	12	5.9		
Toledo	628	208	243	29.28	29.95	−0.4	71.4	−2.3	91	16	80	53	6	63	25	65	62	76	5.54	+2.3	15	8,127	sw.	42	sw.	4	7	15	9	5.7		
Fort Wayne	856	113	124	29.05	29.96	.....	71.0	−2.5	88	13	80	52	5	62	25	65	63	79	4.81	.....	17	5,100	sw.	38	sw.	4	6	12	13	6.2		
Detroit	730	218	245	29.17	29.95	−0.3	70.4	−1.6	87	16	78	51	6	63	24	63	60	75	6.99	+3.5	17	6,485	w.	48	sw.	4	5	15	11	6.4		
Upper Lake Region.							**64.8**	**−3.2**										**76**	**3.12**	**0.00**													**5.7**		
Alpena	609	13	92	29.29	29.96	−0.1	63.2	−2.6	86	16	72	44	6	55	31	59	56	79	3.37	+0.3	13	6,047	nw.	45	w.	5	7	14	10	5.9		
Escanaba	612	54	60	29.28	29.94	−0.3	62.6	−3.9	82	16	71	45	6	54	26	58	54	74	1.88	−1.5	12	6,149	s.	30	nw.	5	15	7	9	4.5		
Grand Haven	632	54	92	29.26	29.93	−0.5	66.2	−3.5	82	10	73	51	23	59	23	62	59	77	2.89	+0.3	10	6,062	w.	30	w.	3	11	15	5	4.6		
Grand Rapids	707	70	87	29.19	29.94	−0.4	69.4	−2.8	90	31	78	51	6	61	27	63	59	71	4.00	+1.4	13	3,689	w.	34	w.	1	6	14	11	6.5		
Houghton	684	62	72	29.21	29.93	−0.3	60.6	−4.7	84	13	70	43	26	51	31	.....	.....	.....	2.91	−0.2	9	5,031	w.	30	w.	23	10	15	6	4.7		
Lansing	878	11	62	29.00	29.93	.....	67.9	−3.2	87	16	78	47	6	58	31	62	60	79	5.17	+2.0	16	2,889	sw.	18	se.	1	4	18	9	6.2		
Ludington	637	60	66	29.25	29.94	.....	64.0	.....	79	10	72	50	9	57	28	60	57	78	2.77	.....	6	5,427	s.	27	w.	5	13	9	9	4.7		
Marquette	734	77	111	29.18	29.98	+0.2	60.2	−4.7	80	10	68	45	25	52	30	56	53	79	1.78	−1.3	11	4,895	e.	30	nw.	5	9	13	9	5.9		
Port Huron	638	70	120	29.26	29.94	−0.4	67.4	−1.6	86	14	75	49	6	60	25	63	60	80	4.69	+2.0	16	5,677	ne.	35	ne.	16	8	15	8	5.9		
Saginaw	641	48	82	29.26	29.94	.....	68.8	.....	90	16	78	47	6	59	30	62	58	72	2.39	−1.3	12	4,761	w.	30	sw.	5	7	10	14	6.5		
Sault Ste. Marie	614	11	61	29.27	29.95	−0.2	62.0	+0.1	83	1	73	40	6	51	32	56	52	75	3.89	+1.1	11	4,615	w.	35	w.	5	7	12	12	6.3		
Chicago	823	140	310	29.08	29.95	−0.3	70.2	−2.2	88	15	76	53	5	64	23	63	60	73	5.57	+1.9	14	6,766	w.	30	ne.	7	7	10	14	6.4		
Green Bay	617	109	144	29.28	29.93	−0.4	65.8	−3.7	88	13	75	48	25	57	29	60	58	78	2.62	−0.9	14	6,419	se.	35	nw.	20	4	17	10	6.5		
Milwaukee	681	119	133	29.21	29.94	−0.3	66.8	−2.9	87	12	74	53	5	60	25	60	57	72	1.91	−1.1	10	5,742	ne.	26	ne.	7	7	13	11	5.8		
Duluth	1,133	11	47	28.76	29.96	+0.1	59.8	−6.2	85	13	70	42	25	50	34	56	53	80	1.60	−2.0	14	7,575	ne.	42	sw.	2	11	11	9	5.1		
North Dakota.							**63.0**	**−6.0**										**71**	**2.38**	**−0.5**													**5.0**		
Moorhead	940	8	57	28.96	29.96	+0.2	65.2	−3.5	87	13	75	44	5	55	29	59	57	78	2.22	−1.5	13	4,677	nw.	24	nw.	4	19	7	5	3.2		
Bismarck	1,674	8	57	28.23	30.00	+0.7	62.6	−7.6	86	9	73	39	5	52	34	56	52	71	4.02	+1.9	17	6,070	e.	42	sw.	9	11	12	8	5.0		
Devils Lake	1,482	11	44	28.39	29.94	+0.1	62.4	−5.7	86	12	74	40	5	51	36	56	51	70	1.00	−2.8	11	6,565	ne.	34	w.	16	8	8	15	6.1		
Williston	1,872	40	47	27.98	29.94	+0.2	62.0	−7.4	87	9	73	42	20	52	34	54	49	66	2.21	+0.2	12	5,120	e.	32	nw.	1	6	14	11	6.0		
Upper Mississippi Valley.							**71.6**	**−3.8**										**76**	**6.24**	**+2.6**													**6.2**		
Minneapolis	918	10	208	28.96	29.93	.....	67.2	.....	88	12	76	50	4	59	22	.....	.....	.....	5.92	+2.1	11	7,077	nw.	36	nw.	4	6	10	15	6.5		
St. Paul	837	201	236	29.03	29.92	−0.3	67.1	−5.0	88	13	76	49	4	59	23	.....	.....	.....	4.53	+1.1	11	7,215	nw.	37	nw.	4	3	20	8	5.8		
La Crosse	714	11	48	29.16	29.91	−0.5	68.7	−3.9	89	15	78	50	3	59	28	.....	.....	.....	5.28	+1.2	14	2,892	s.	16	e.	18	4	10	17	7.1		
Madison	974	70	78	28.92	29.95	−0.2	67.7	−4.7	88	13	76	50	5	59	23	62	59	76	5.04	+1.0	16	5,182	w.	40	ne.	21	2	11	18	7.6		
Charles City	1,015	10	49	28.88	29.94	−0.2	67.9	−5.6	90	15	77	47	3	59	28	63	61	80	6.50	+2.9	14	3,927	nw.	24	nw.	4	6	14	11	6.0		
Davenport	606	71	79	29.28	29.94	−0.3	71.9	−3.5	89	17	80	52	5	63	25	65	62	75	8.05	+4.5	16	4,258	sw.	28	s.	13	5	16	10	5.8		
Des Moines	861	84	97	29.04	29.92	−0.4	71.0	−4.5	91	15	80	51	3	63	24	65	62	75	9.39	+5.5	15	4,371	nw.	33	se.	10	5	14	12	6.7		
Dubuque	698	81	96	29.21	29.95	−0.2	69.6	−5.1	87	31	78	51	5	61	27	64	60	76	5.08	+0.8	20	3,644	nw.	24	se.	10	4	10	17	7.0		
Keokuk	614	64	78	29.29	29.95	−0.3	72.9	−4.1	91	17	81	53	5	64	23	67	64	77	6.34	+2.3	17	4,305	nw.	30	n.	18	8	12	11	6.0		
Cairo	356	87	93	29.58	29.95	−0.5	78.1	−0.5	97	30	87	60	5	69	23	70	67	73	3.51	+0.1	8	5,187	s.	37	se.	1	11	14	6	4.5		
Peoria	644	10	91	29.30	29.96	−0.2	71.9	−3.5	91	14	81	51	5	63	29	67	65	81	6.91	+3.9	17	3,246	s.	26	nw.	18	6	14	11	5.8		
Springfield, Ill.	644	10	91	29.27	29.94	−0.4	74.0	−2.5	92	15	83	51	5	65	25	67	64	74	5.72	+2.8	15	4,871	s.	35	w.	10	5	14	12	6.2		
Hannibal	534	74	109	29.37	29.94	−0.4	73.4	−4.0	92	14	82	52	5	64	25	.....	.....	.....	9.00	+5.2	17	5,288	sw.	37	w.	30	9	9	13	5.8		
St. Louis	567	265	303	29.35	29.95	−0.4	76.4	−2.7	94	15	85	55	5	68	27	70	67	77	6.02	+2.6	10	8,052	sw.	42	nw.	10	9	12	10	5.3		
Missouri Valley.							**71.2**	**− 4.5**										**76**	**6.15**	**+ 2.3**													**5.2**		
Columbia, Mo.	781	11	84	29.12	29.93	− .05	74.1	− 3.3	93	30	83	50	5	65	27	.....	.....	.....	3.55	− 0.1	13	4,507	nw.	31	ne.	14	4	11	16	6.9		
Kansas City	963	161	181	28.93	29.94	− .03	74.6	− 3.0	90	14	83	56	5	66	23	67	64	74	6.67	+ 1.8	16	7,508	s.	56	nw.	18	9	15	7	5.5		
St. Joseph	967	11	49	28.92	29.94	.....	73.3	.....	91	15	82	54	4	64	26	67	64	78	12.92	.....	17	4,953	nw.	46	nw.	18	10	10	11	5.3		
Springfield, Mo.	1,324	98	104	28.60	29.98	.00	74.0	− 2.4	92	30	83	51	5	65	27	67	63	72	1.82	− 3.0	8	6,259	s.	44	s.	12	21	8	2	2.5		
Iola	984	11	50	28.91	29.92	− .05	75.0	− 3.1	94	18	85	49	5	65	29	.....	.....	.....	6.07	+ 2.2	15	4,598	s.	37	ne.	18	11	16	4	4.2		
Topeka	983	85	101	.....	.....	.....	74.0	− 3.6	93	18	83	54	5	65	28	.....	.....	.....	7.86	+ 3.0	12	6,292	s.	37	ne.	12	11	13	7	5.0		
Drexel	1,299	10	53	28.58	29.94	.....	69.6	.....	90	15	79	48	4	60	27	65	62	81	8.23	.....	15	5,996	se.	68	se.	18	9	15	7	5.3		
Lincoln	1,189	11	84	28.68	29.92	− .03	71.7	− 4.7	95	15	81	48	4	62	29	65	62	77	6.74	+ 2.9	19	6,201	se.	53	nw.	15	11	13	7	5.2		
Omaha	1,105	115	121	28.78	29.93	− .02	71.3	− 5.2	92	15	79	51	4	63	25	65	62	75	7.75	+ 3.4	18	4,969	nw.	42	nw.	15	11	11	9	5.1		
Valentine	2,598	47	54	27.28	29.96	+ .03	67.6	− 5.6	92	6	79	39	5	56	41	60	56	73	7.40	+ 4.0	15	6,577	ne.	38	w.	6	5	21	5	5.5		
Sioux City	1,135	94	164	28.74	29.93	− .02	69.8	− 4.4	90	23	78	48	4	61	28	64	62	79	7.45	+ 3.8	15	7,147	nw.	44	w.	29	12	10	9	5.1		
Huron	1,306	59	74	28.58	29.96	+ .02	66.0	− 5.5	92	12	76	43	4	56	30	62	59	79	4.14	+ 1.2	13	6,426	nw.	46	se.	13	7	14	10	5.7		
Pierre	1,572	70	75	28.32	29.97	+ .04	67.5	− 7.7	89	12	77	44	5	58	31	61	56	70	6.12	+ 3.8	16	6,274	se.	45	n.	15	11	14	6	5.2		
Yankton	1,233	49	57	28.62	29.92	− .02	69.0	− 5.6	90	12	78	46	4	60	29	.....	.....	.....	8.21	+ 4.7	14	4,719	nw.	32	nw.	17	3	20	8	6.5		

TABLE I.—*Climatological data for United States Weather Bureau stations, July, 1915*—Continued.

Districts and stations.	Elevation of instruments.			Pressure.			Temperature of the air.												Mean wet thermometer.	Mean temperature of the dew point.	Mean relative humidity.	Precipitation.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness.	Total snowfall.	Snow on ground at end of month.
	Barometer above sea level.	Thermometer above ground.	Anemometer above ground.	Station, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean max.+mean min.÷2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.						Total.	Departure from normal.	Days with 0.01 or more.	Total movement.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.						
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F*		°*F*	°*F.*		°*F*	°*F.*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles.*								*0–10*		
Northern Slope.							**62.6**	**– 5.3**										**66**	**3.09**	**+ 1.5**										**5.1**		
Havre	2,505	11	44	27.36	29.96	+0.05	62.4	– 5.7	91	22	74	37	4	50	39	56	52	74	3.17	+ 1.2	15	3,988	e.	30	sw.	9	13	11	7	4.9		
Helena	4,110	87	114	25.83	29.97	+ .04	61.1	– 5.5	92	22	72	39	2	50	36	52	45	61	2.88	+ 1.8	19	5,726	sw.	38	sw.	27	10	12	9	5.3		
Kalispell	2,962	11	34	26.94	29.95	+ .02	60.0	– 4.3	90	22	73	39	11	47	39	52	47	68	2.74	+ 1.9	13	2,703	w.	18	sw.	11	10	13	8	4.7		
Miles City	2,371	26	48	27.48	29.99	+ .07	67.5	– 5.4	93	23	79	42	2	56	36	58	53	66	5.51	+ 4.1	19	3,653	n.	30	sw.	28	6	20	5	4.8		
Rapid City	3,259	50	58	26.62	29.99	+ .06	63.8	– 6.4	87	13	74	41	5	54	35	56	51	66	4.62	+ 2.1	18	5,662	n.	37	sw.	12	5	21	5	5.4		
Cheyenne	6,088	84	101	24.07	29.92	.00	62.3	– 5.1	89	11	75	33	4	50	39	53	47	66	1.71	– 0.3	10	8,008	s.	50	w.	6	6	20	5	5.6		
Lander	5,372	60	68	24.68	29.92	.00	63.0	– 5.0	93	22	78	38	10	48	46	50	40	50	0.75	– 0.1	11	3,758	sw.	42	nw.	23	8	21	2	4.4		
Sheridan	3,790	10	47	26.13	29.98	.....	61.2	.....	89	22	74	36	2	48	43	54	49	69	1.44	.....	13	3,890	nw.	38	sw.	31	11	10	10	5.2	T.	
Yellowstone Park	6,200	11	48	23.94	29.96	+ .04	55.8	– 5.7	85	22	70	31	4	42	41	46	41	67	1.77	+ 0.6	15	5,020	nw.	37	nw.	22	6	13	12	6.1		
North Platte	2,821	11	51	27.09	29.97	+ .04	69.4	– 4.5	92	17	81	41	4	58	36	62	59	76	4.66	+ 2.0	15	4,913	se.	37	nw.	9	12	10	9	4.9		
Middle Slope.							**73.7**	**– 3.1**										**66**	**2.87**	**– 0.1**										**4.6**		
Denver	5,291	129	172	24.77	29.92	+ .01	68.7	– 3.1	96	11	82	46	2	55	38	56	48	56	1.28	– 0.3	10	5,313	sw.	41	ne.	1	12	11	8	4.7		
Pueblo	4,685	80	86	25.31	29.91	.00	71.1	– 3.1	99	11	84	51	7	58	42	56	48	56	1.91	– 0.1	9	4,980	se.	34	nw.	13	16	11	4	4.1		
Concordia	1,392	50	58	28.49	29.93	– .02	73.7	– 4.4	95	15	83	52	4	64	26	67	64	74	5.10	+ 1.5	17	5,264	s.	34	nw.	10	5	17	9	6.2		
Dodge	2,509	11	51	27.36	29.89	– .04	74.3	– 3.4	98	18	86	51	4	63	31	65	61	69	3.92	+ 0.5	13	7,070	s.	42	nw.	8	11	14	6	5.0		
Wichita	1,358	139	158	28.51	29.91	– .05	76.1	– 2.9	94	18	86	55	5	67	25	68	64	70	3.82	+ 0.2	11	9,239	s.	40	sw.	10	18	10	3	3.8		
Oklahoma	1,214	10	47	28.69	29.94	– .02	78.2	– 1.6	95	29	88	55	5	60	26	69	65	68	1.19	– 2.5	4	9,908	s.	38	s.	6	13	18	0	3.6		
Southern Slope.							**79.8**	**– 0.6**										**59**	**2.31**	**– 0.5**										**3.3**		
Abilene	1,738	10	52	28.15	29.90	– .03	81.6	– 0.6	100	18	93	55	5	71	29	68	61	55	0.80	– 1.6	4	8,321	s.	31	sw.	30	21	2	8	3.4		
Amarillo	3,676	10	49	26.27	29.92	.00	74.6	– 1.5	102	11	86	52	5	64	32	64	59	66	4.14	+ 1.0	14	8,893	s.	44	sw.	9	15	10	6	4.0		
Del Rio	944	64	71	28.92	29.88	– .02	85.5	+ 0.8	101	2	96	67	25	75	32	.....	.....	.....	3.85	+ 1.6	4	8,503	se.	32	sw.	31	22	9	0	2.8		
Roswell	3,566	75	85	26.34	29.86	– .02	77.6	– 1.3	102	10	90	60	4	65	37	63	55	55	0.45	– 3.0	9	5,687	s.	38	se.	8	4	21	6	5.9		
Southern Plateau.							**80.4**	**– 1.4**										**46**	**1.66**	**+ 0.4**										**3.1**		
El Paso	3,762	110	133	26.14	29.78	– .06	81.1	+ 0.6	103	9	94	64	11	69	35	64	53	48	2.45	+ 0.3	13	8,156	nw.	54	nw.	11	9	20	2	4.7		
Santa Fe	7,013	57	62	23.34	29.84	– .04	67.6	– 1.1	88	16	79	50	4	56	31	53	43	51	4.37	+ 1.7	11	5,356	se.	38	s.	5	11	14	6	5.1		
Flagstaff	6,908	8	57	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Phoenix	1,108	76	81	28.64	29.75	– .03	87.3	– 3.1	107	1	100	66	7	75	37	68	56	40	1.12	0.0	5	4,109	e.	24	sw.	27	20	5	6	2.9		
Yuma	141	9	54	29.59	29.73	– .03	90.0	– 0.9	110	24	105	63	6	75	41	71	62	45	0.34	+ 0.2	1	4,328	w.	22	se.	27	26	4	1	1.1		
Independence	3,910	11	42	25.88	29.76	– .07	76.2	– 2.3	98	24	92	45	6	60	40	.....	.....	.....	0.04	0.0	1	4,774	se.	34	nw.	5	24	6	1	1.5		
Middle Plateau.							**72.1**	**– 0.8**										**36**	**0.32**	**– 0.2**										**2.7**		
Reno	4,532	74	81	25.46	29.86	– .01	69.2	+ 1.7	95	24	85	42	7	53	43	52	39	42	0.04	– 0.1	2	5,666	w.	34	w.	13	22	1	8	2.3		
Tonopah	6,090	12	20	24.08	29.86	.....	71.0	.....	89	25	83	46	6	59	30	51	86	34	0.21	– 0.1	3	6,157	w.	37	nw.	5	18	11	2	2.8		
Winnemucca	4,344	18	56	25.57	29.88	– .02	69.7	– 1.9	98	21	87	42	7	52	42	51	36	39	0.05	– 0.1	3	4,316	sw.	28	nw.	30	26	3	2	2.1		
Modena	5,479	10	43	24.61	29.83	– .03	69.2	– 0.5	91	21	84	45	6	54	38	50	34	36	1.41	+ 0.2	5	9,248	sw.	51	e.	24	18	8	5	3.0		
Salt Lake City	4,360	147	189	25.56	29.82	– .08	75.2	– 1.0	94	22	86	56	18	64	30	55	40	31	0.07	– 0.5	1	6,154	nw.	31	se.	28	21	7	3	2.8		
Grand Junction	4,602	82	96	25.33	29.82	– .07	77.1	– 2.1	97	11	91	56	4	64	35	56	40	31	0.16	– 0.3	3	5,932	e.	36	w	28	16	14	1	3.2		
Northern Plateau.							**69.3**	**– 1.6**										**45**	**0.85**	**+ 0.4**										**4.1**		
Baker	3,471	48	53	26.45	29.99	+ .04	63.1	– 1.9	96	21	78	38	17	49	44	50	41	52	1.09	+ 0.7	9	4,153	nw.	20	sw.	4	15	11	5	4.1		
Boise	2,739	78	86	27.10	29.90	– .03	70.6	– 2.2	100	21	85	45	17	56	40	54	40	41	0.63	+ 0.4	6	3,917	nw	32	nw.	16	18	7	3	3.5		
Lewiston	757	40	48	29.12	29.91	– .04	72.7	– 0.9	104	21	87	50	18	59	44	.....	.....	.....	0.89	+ 0.5	9	2,595	e.	20	nw.	16	15	6	10	4.2		
Pocatello	4,477	46	54	25.45	29.88	– .04	67.8	– 3.4	94	22	82	43	18	53	42	51	38	43	0.98	+ 0.4	8	4,578	se.	32	s.	31	11	18	2	4.0		
Spokane	1,929	101	110	27.91	29.92	– .04	68.7	– 0.1	98	21	80	47	14	57	38	55	44	49	0.85	+ 0.2	10	4,715	sw.	26	sw.	9	9	15	7	5.0		
Walla Walla	1,000	57	65	28.85	29.90	– .07	73.0	– 1.1	101	21	85	53	18	61	40	57	45	42	0.65	+ 0.3	4	3,927	s.	22	n.	3	15	12	4	3.7		
North Pacific Coast Region.							**61.9**	**+ 0.7**										**76**	**1.12**	**+ 0.4**										**5.7**		
North Head	211	11	56	29.84	30.07	– .01	57.6	– 0.1	65	19	60	51	23	56	10	56	55	90	1.61	+ 1.1	19	10,454	nw.	44	se.	8	3	7	21	7.3		
Port Crescent	259	8	53	29.78	30.06	.00	56.4	+ 0.1	85	1	63	40	18	49	38	.....	.....	.....	0.97	+ 0.4	11	3,302	w.	16	nw.	14	6	17	8	5.6		
Seattle	125	215	250	29.90	30.03	– .01	64.3	+ 0.8	89	20	72	52	13	56	27	58	54	72	0.84	+ 0.2	6	5,849	s.	30	sw.	12	9	8	14	5.6		
Tacoma	213	113	120	29.80	30.02	– .04	64.2	+ 0.8	90	20	73	51	9	55	31	57	53	71	0.91	+ 0.2	9	4,154	sw.	20	w.	12	9	8	14	5.5		
Tatoosh Island	109	7	57	29.94	30.03	– .02	55.8	+ 0.7	76	1	60	48	7	52	24	54	54	94	1.37	– 0.4	12	7,335	s.	36	s.	25	4	5	22	7.4		
Portland, Oreg.	153	68	106	29.85	30.01	– .04	67.2	+ 0.9	100	20	76	54	18	58	34	59	54	66	1.52	+ 1.0	8	3,896	nw.	21	w.	16	11	8	12	4.9		
Roseburg	510	9	57	29.48	30.02	– .01	67.8	+ 1.7	98	20	80	46	18	56	43	58	52	64	0.64	+ 0.3	5	2,725	n.	14	n.	17	13	13	5	3.8		
Middle Pacific Coast Region.							**65.8**	**+ 0.3**										**61**	**0.04**	**0.0**										**2.6**		
Eureka	62	73	89	29.98	30.05	.00	56.8	+ 1.5	66	7	60	48	17	53	13	54	52	86	0.26	+ 0.2	4	5,387	n.	29	n.	14	6	17	8	5.5		
Mount Tamalpais	2,375	11	18	27.50	29.94	– .01	68.7	– 1.8	91	24	76	46	5	61	21	54	41	43	0.03	0.0	2	13,005	nw.	72	nw.	30	28	2	1	0.7		
Point Reyes Light	490	7	18	29.39	29.91	.....	54.4	+ 0.7	64	6	58	47	18	51	12	.....	.....	.....	0.04	.....	1	18,591	nw.	72	nw.	13	6	11	14	6.3		
Red Bluff	332	50	56	29.49	29.83	– .06	80.5	– 1.6	109	22	95	53	5	66	38	61	48	37	T.	0.0	0	3,648	s.	23	n.	17	29	1	1	0.8		
Sacramento	69	106	117	29.78	29.85	– .03	72.8	+ 0.3	102	21	87	51	3	58	40	60	51	55	T.	0.0	0	6,486	s.	24	s.	4	29	2	0	0.5		
San Francisco	155	209	213	29.76	29.93	– .02	60.2	+ 2.9	79	17	67	51	31	53	24	55	52	82	0.01	0.0	1	8,901	sw.	36	sw.	26	19	8	4	3.1		
San Jose	141	12	110	29.79	29.94	.....	67.1	+ 0.2	93	21	80	49	19	54	38	.....	.....	.....	0.00	0.0	0	4,854	nw.	29	nw.	6	30	1	0	1.2		
South Pacific Coast Region.							**70.3**	**+ 0.4**										**66**	**T.**	**0.0**										**2.4**		
Fresno	327	89	98	29.49	29.84	+ .01	80.3	– 1.7	108	25	96	54	6	64	37	60	45	36	0.00	0.0	0	6,950	nw.	26	nw.	6	30	1	0	0.6		
Los Angeles	338	159	191	29.54	29.90	.00	70.0	+ 2.6	88	21	79	57	6	61	25	62	58	73	0.00	0.0	0	3,582	sw.	15	w.	19	17	13	1	3.2		
San Diego	87	62	70	29.81	29.90	– .02	67.5	+ 0.6	82	21	72	56	7	63	18	62	60	80	T.	0.0	0	4,804	w.	19	nw.	19	24	7	0	2.7		
San Luis Obispo	201	32	40	29.74	29.96	+ .01	63.3	+ 0.1	87	20	75	46	30	52	33	56	52	75	0.01	0.0	1	3,005	nw.	20	w.	7	17	14	0	3.3		
West Indies.																																		
San Juan	82	8	54	29.93	30.01	+ .02	81.2	.....	91	17	86	71	20	77	15	.....	.....	.....	5.50	– 0.9	24	11,191	e.	35	e.	8	12	16	3	4.6		
Panama.																																		
Balboa Heights	116	7	97	29.71	29.84	.....	79.8	.....	90	29	85	70	17	74	15	76	76	92	6.93	– 0.8	22	4,375	nw.	33	nw.	28	0	0	31	9.2		
Colon	25	5	71	29.80	29.83	.....	80.2	.....	89	20	84	72	1	76	12	78	77	92	20.72	+ 4.4	29	5,590	w.	26	w.	1	0	0	31	9.3		

TABLE II.—*Accumulated amounts of precipitation for each 5 minutes, for the principal storms in which the rate of fall equaled or exceeded 0.25 inch in any 5 minutes, or 0.80 in 1 hour, during July, 1915, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive rate began.	Depths of precipitation (in inches) during periods of time indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
Abilene, Tex.	31			0.53														0.20			
Albany, N. Y.	7–8			2.95														.61			
Alpena, Mich.	11–12	10:50 p. m.	1:30 a. m.	1.42	12:43 a. m.	1:05 a. m.	0.11	0.27	0.68	1.11	1.28	1.29									
Amarillo, Tex.	13	D. N. a. m.	D. N. a. m.	0.79	1:52 a. m.	2:10 a. m.	.08	.15	.31	.47	.55										
	15–16	11:15 p. m.	2:00 a. m.	1.69	11:37 p. m.	11:58 p. m.	.03	.09	.16	.39	.57	.58									
					12:55 a. m.	1:19 a. m.	.99	.06	.17	.23	.49	.64									
Anniston, Ala.	5			1.72														.43			
Asheville, N. C.	4	5:00 p. m.	5:30 p. m.	0.67	5:07 p. m.	5:38 p. m.	.03	.09	.16	.25	.41	.51	0.56	0.61							
Atlanta, Ga.	20	10:40 a. m.	12:00 m.	0.81	11:01 a. m.	11:34 a. m.	.04	.07	.23	.46	.57	.59	.65	.72							
Atlantic City, N. J.	17			0.43														.38			
Augusta, Ga.	19–20	11:15 p. m.	D. N. a. m.	1.04	11:34 p. m.	12:03 a. m.	.20	.18	.30	.46	.52	.58	.65	.78							
Baker, Oreg.	8–9			0.40														.13			
Baltimore, Md.	11	8:55 p. m.	9:25 p. m.	0.72	9:05 p. m.	9:21 p. m.	.05	.11	.43	.64	.67										
Bentonville, Ark.	18–19	12:12 p. m.	9:10 a. m.	1.05	10:27 p. m.	10:52 p. m.	.01	.10	.18	.37	.46	.53									
Binghamton, N. Y.	8	8:37 a. m.	3:30 p. m.	3.12	8:43 a. m.	9:43 a. m.	.03	.05	.09	.14	.22	.32	.50	.60	0.71	0.79	0.82	.96			
Birmingham, Ala.	1	1:45 a. m.	D. N. a. m.	0.90	1:49 a. m.	2:15 a. m.	.01	.12	.37	.56	.66	.82	.86								
	9	5:44 p. m.	9:55 p. m.	1.27	6:17 p. m.	6:47 p. m.	.01	.23	.61	.83	1.02	1.11	1.17								
Bismarck, N. Dak.	13–14	10:05 p. m.	D. N. a. m.	1.40	11:21 p. m.	11:52 p. m.	.39	.07	.23	.35	.49	.66	.74	.78							
Block Island, R. I.	19			0.22														.21			
Boise, Idaho.	9			0.28														.23			
Boston, Mass.	1	2:00 a. m.	7:30 a. m.	3.37	3:53 a. m.		.35	.09	.43	.19	.26	.35	.46	.59	.70	.80	1.00				
								1.11	1.20	1.25	1.30	1.40	1.54	1.66	1.74	1.83	1.89				
								1.97	2.07	2.19	2.25	2.33	2.44	2.51	2.64	2.76	2.81				
						6:43 a. m.		2.86	2.91	2.96	3.01										
Buffalo, N. Y.	28			0.80														.62			
Burlington, Vt.	17	D. N. a. m.	9:00 a. m.	0.69	7:43 a. m.	8:04 a. m.	.16	.05	.13	.25	.41	.45									
Cairo, Ill.	7	9:50 p. m.	D. N. p. m.	2.00	10:00 p. m.	10:48 p. m.	.01	.16	.33	.63	1.26	1.56	1.74	1.76	1.78	1.92	1.98				
Canton, N. Y.	17	12:46 p. m.	1:40 p. m.	1.01	12:46 p. m.	1:07 p. m.	.00	.28	.73	.90	.97	.99									
Charles City, Iowa.	15	5:26 p. m.	8:30 p. m.	1.10	5:26 p. m.	6:01 p. m.	.00	.08	.27	.50	.55	.60	.65	.73							
	18	1:50 a. m.	4:00 a. m.	0.98	1:56 a. m.	2:21 a. m.	.02	.06	.20	.44	.54	.63									
	30	10:14 a. m.	12:40 p. m.	1.31	10:49 a. m.	11:19 a. m.	.03	.12	.39	.59	.90	1.03	1.11								
Charleston, S. C.	5	5:45 p. m.	6:45 p. m.	0.63	5:48 p. m.	6:10 p. m.	.01	.15	.31	.39	.51	.57									
Charlotte, N. C.	8	3:37 p. m.	4:33 p. m.	0.61	3:47 p. m.	4:03 p. m.	.03	.23	.29	.52	.55										
	13	12:18 p. m.	1:42 p. m.	0.70	12:30 p. m.	1:03 p. m.	.05	.10	.20	.35	.46	.62									
Chattanooga, Tenn.	4–5	3:49 p. m.	6:29 a. m.	2.39	12:57 a. m.	1:47 a. m.	1.04	.09	.17	.33	.51	.57	.62								
Cheyenne, Wyo.	13	12:50 p. m.	1:41 p. m.	0.56	1:18 p. m.	1:41 p. m.	.01	.11	.19	.31	.52	.56	.73	.80	.91	1.10					
	29	1:46 p. m.	2:10 p. m.	0.50	1:46 p. m.	2:01 p. m.	.00	.17	.32	.48											
Chicago, Ill.	7	2:45 p. m.	8:45 p. m.	0.81	3:41 p. m.	3:54 p. m.	.19	.20	.33	.45											
Cincinnati, Ohio.	7	8:55 p. m.	D. N. p. m.	1.05	9:21 p. m.	9:40 p. m.	.08	.06	.13	.56	.65										
	28	11:52 a. m.	12:59 p. m.	0.93	11:53 a. m.	12:13 p. m.	.01	.18	.46	.61	.89										
Cleveland, Ohio.	14–15	10:45 p. m.	5:15 a. m.	0.96	2:59 a. m.	3:25 a. m.	.02	.07	.14	.32	.47	.67	.72								
	25	8:02 p. m.	10:42 p. m.	0.87	8:19 p. m.	8:44 p. m.	.02	.05	.22	.46	.67	.72									
Columbia, Mo.	12	7:42 a. m.	10:03 a. m.	0.92	8:31 a. m.	9:06 a. m.	.05	.22	.33	.39	.43	.51	.59	.73							
Columbia, S. C.	19–20			0.99														.58			
Columbus, Ohio.	4	6:35 p. m.	9:35 p. m.	0.86	6:55 p. m.	7:34 p. m.	.03	.19	.28	.39	.47	.53	.55	.62	.69						
	15	4:50 p. m.	6:15 p. m.	0.67	4:53 p. m.	5:07 p. m.	.02	.28	.49	.57											
	20	3:25 p. m.	7:15 p. m.	1.08	3:51 p. m.	4:05 p. m.	.05	.21	.66	.82											
Concord, N. H.	8			3.05														.77			
Concordia, Kans.	16	2:28 a. m.	4:54 a. m.	1.56	2:30 a. m.	3:30 a. m.	.01	.14	.29	.50	.62	.77	.85	.90	1.00	1.04	1.08	1.16			
	30	1:05 a. m.	3:30 a. m.	0.78	1:12 a. m.	1:29 a. m.	.01	.23	.31	.51	.56										
Corpus Christi, Tex.	26			0.02														.02			
Davenport, Iowa.	7	3:55 p. m.	5:24 p. m.	2.74	4:19 p. m.	5:05 p. m.	.05	.29	.54	.81	1.07	1.35	1.64	2.11	2.42	2.63	2.69				
	13	7:31 p. m.	8:00 p. m.	1.38	7:34 p. m.	7:56 p. m.	.01	.37	.66	.92	1.30	1.37									
Dayton, Ohio.	7	6:20 p. m.	11:10 p. m.	2.13	8:55 p. m.	9:50 p. m.	.29	.13	.21	.41	.48	.55	.60	.81	1.08	1.33	1.48	1.64			
Del Rio, Tex.	21	11:55 a. m.	3:50 p. m.	2.46	12:42 p. m.	1:30 p. m.	.44	.19	.26	.33	.48	.85	1.06	1.19	1.34	1.47	1.52				
	31	4:50 p. m.	7:20 p. m.	1.02	4:52 p. m.	5:33 p. m.	.01	.14	.34	.50	.57	.61	.64	.74	.85	.96					
Denver, Colo.	2–3	9:35 p. m.	D. N. a. m.	0.35	9:38 p. m.	9:46 p. m.	.01	.23	.32												
Des Moines, Iowa.	7	12:40 a. m.	4:30 a. m.	1.28	1:56 a. m.	2:22 a. m.	.08	.18	.51	.85	1.04	1.08									
	10	6:04 a. m.	9:35 a. m.	0.97	7:16 a. m.	7:33 a. m.	.09	.16	.34	.63	.70										
	18	1:50 a. m.	3:45 a. m.	0.67	1:58 a. m.	2:18 a. m.	.01	.17	.35	.44	.50										
Detroit, Mich.	16	12:18 p. m.	12:35 p. m.	0.82	12:20 p. m.	12:31 p. m.	.01	.33	.76	.81											
	30	D. N. a. m.	D. N. a. m.	1.75	1:23 a. m.	2:13 a. m.	.01	.17	.25	.35	.57	.83	.99	1.24	1.39	1.58	1.72				
Devils Lake, N. Dak.	12			0.22														.14			
Dodge City, Kans.	8	10:55 p. m.	11:40 p. m.	0.60	11:00 p. m.	11:26 p. m.	.02	.07	.10	.18	.33	.48	.50								
	16	7:55 p. m.	9:55 p. m.	0.98	8:41 p. m.	9:29 p. m.	.01	.06	.14	.42	.58	.63	.68	.72	.79	.86	.91				
Dubuque, Iowa.	7	D. N. a. m.	10:45 a. m.	1.72	5:42 a. m.	6:12 a. m.	.35	.06	.17	.27	.41	.50	.56								
Duluth, Minn.	20			0.21														.19			
Eastport, Me.	8–9			2.02														.51			
Elkins, W. Va.	11			0.36														.34			
El Paso, Tex.	23			0.59														.50			
Erie, Pa.	12	5:00 a. m.	6:10 a. m.	0.86	5:16 a. m.	5:51 a. m.	.02	.17	.34	.52	.64	.67	.76	.81							
Escanaba, Mich.	4			0.76														.22			
Eureka, Cal.	6			0.17														.03			
Evansville, Ind.	12	4:30 p. m.	6:00 p. m.	0.75	5:26 p. m.	5:48 p. m.	.21	.15	.30	.42	.53	.54									
	17	D. N. a. m.	6:30 a. m.	0.63	4:34 a. m.	4:51 a. m.	.02	.10	.31	.51	.55										
Fort Smith, Ark.	19			0.39														.30			
Fort Wayne, Ind.	14–15	7:05 p. m.	7:10 a. m.	1.00	7:58 p. m.	8:23 p. m.	.09	.06	.14	.30	.55	.60									
Fort Worth, Tex.	4			0.15														.12			
Fresno, Cal.	‡																				
Galveston, Tex.	21	1:55 p. m.	4:10 p. m.	1.30	2:21 p. m.	2:51 p. m.	.03	.23	.65	.91	1.06	1.13	1.19								
Grand Haven, Mich.	15			0.46														.38			
Grand Junction, Colo.	29			0.13														.13			
Grand Rapids, Mich.	1	12:38 p. m.	2:00 p. m.	1.41	12:42 p. m.	1:22 p. m.	.01	.11	.39	.67	.91	1.10	1.15	1.28	1.38						
Green Bay, Wis.	24			0.76														.35			
Hannibal, Mo.	7	1:47 p. m.	2:32 p. m.	1.30	2:06 p. m.	2:25 p. m.	.02	.22	.53	1.07	1.28										
	10	10:42 a. m.	1:18 p. m.	0.71	10:58 a. m.	11:16 a. m.	.01	.14	.31	.47	.55										
		8:43 p. m.	D. N. p. m.	1.00	9:19 p. m.	9:44 p. m.	.12	.19	.37	.45	.61	.74									
	30	4:09 p. m.	6:10 p. m.	1.53	4:11 p. m.	4:35 p. m.	.01	.31	.76	1.04	1.16										
Harrisburg, Pa.	8	9:30 a. m.	1:25 p. m.	1.75	11:37 a. m.	12:13 p. m.	.15	.16	.37	.58	.73	.89	1.37	1.55	1.60						
Hartford, Conn.	14	6:27 p. m.	6:55 p. m.	0.51	6:29 p. m.	6:42 p. m.	.01	.17	.43	.50											
	31	6:15 p. m.	7:40 p. m.	1.00	6:15 p. m.	7:26 p. m.	.00	.05	.11	.20	.23	.30	.38	.50	.57	.65	.70	.86	1.00		
Hatteras, N. C.	5	11:30 a. m.	12:40 p. m.	0.68	11:37 a. m.	11:45 a. m.	.01	.24	.35												
Havre, Mont.	9			0.50														.34			
Helena, Mont.	26–27			0.68														.42			
Houghton, Mich.	4–5			0.68														*			
Houston, Tex.	3	9:10 a. m.	12:05 p. m.	0.78	9:26 a. m.	9:52 a. m.	.03	.20	.31	.44	.47	.64	.71								
	20	6:05 p. m.	D. N. p. m.	1.24	6:17 p. m.	7:07 p. m.	.06	.13	.26	.32	.50	.56	.57	.63	.76	.91	1.03				
Huron, S. Dak.	26			1.21														*			
Independence, Cal.	21			0.04														.04			

* Self-register not working.

‡ No precipitation occurred during month.

TABLE II.—*Accumulated amounts of precipitation for each 5 minutes, for the principal storms in which the rate of fall equaled or exceeded 0.25 inch in any 5 minutes, or 0.80 in 1 hour, during July, 1915, at all stations furnished with self-registering gages*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive rate began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
Indianapolis, Ind.	7	2:46 p. m.	9:20 p. m.	4.13	3:13 p. m.	4:13 p. m.	0.01	0.08	0.14	0.22	0.42	0.65	0.79	0.87	0.97	1.15	1.45	1.71	.....	.....	.....
					6:13 p. m.	6:42 p. m.	2.05	.19	.59	.95	1.23	1.36	1.40	.....	.....	.....	.....	.....	.....	.....	.....
	28	3:46 p. m.	4:30 p. m.	0.77	4:06 p. m.	4:20 p. m.	.01	.23	.47	.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Iola, Kans.	12	7:35 a. m.	9:38 a. m.	1.18	8:01 a. m.	8:36 a. m.	.01	.23	.53	.70	.77	.88	.93	.98	.....	.....	.....	.....	.....	.....	.....
	15	12:40 a. m.	3:43 a. m.	0.78	12:43 a. m.	1:12 a. m.	.01	.13	.29	.41	.50	.62	.68	.....	.....	.....	.....	.....	.....	.....	.....
	18	6:38 p. m.	7:35 p. m.	0.87	6:41 p. m.	7:24 p. m.	.01	.14	.26	.37	.44	.56	.61	.71	.81	.85	.....	.....	.....	.....	.....
	5	5:40 p. m.	7:50 p. m.	1.53	5:47 p. m.	6:04 p. m.	.01	.16	.41	.62	.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
					7:03 p. m.	7:32 p. m.	.82	.07	.23	.32	.46	.60	.70	.....	.....	.....	.....	.....	.....	.....	.....
Jacksonville, Fla.	6	2:50 p. m.	3:35 p. m.	0.62	3:10 p. m.	3:24 p. m.	.03	.12	.34	.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	7	1:35 p. m.	3:20 p. m.	1.22	1:56 p. m.	2:19 p. m.	.01	.34	.76	.98	1.13	1.20	.....	.....	.....	.....	.....	.....	.....	.....	.....
	10	11:41 a. m.	2:15 p. m.	1.45	11:43 a. m.	12:11 p. m.	.01	.20	.50	.84	1.08	1.34	1.40	.....	.....	.....	.....	.....	.....	.....	.....
	14	2:58 p. m.	7:15 p. m.	1.34	3:01 p. m.	3:26 p. m.	.01	.27	.62	.98	1.16	1.25	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kalispel, Mont.	27	.....	.....	0.36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.23	.....	.....	.....
Kansas City, Mo.	12	5:18 a. m.	7:45 a. m.	1.02	5:20 a. m.	5:59 a. m.	.01	.06	.16	.48	.52	.56	.62	.74	.81	.....	.....	.....	.....	.....	.....
	24	1:25 a. m.	5:45 a. m.	1.19	3:04 a. m.	3:25 a. m.	.04	.20	.30	.41	.55	.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
Keokuk, Iowa.	7	3:50 a. m.	5:30 a. m.	0.94	4:01 a. m.	4:33 a. m.	.03	.08	.31	.32	.36	.58	.69	.74	.....	.....	.....	.....	.....	.....	.....
		2:50 p. m.	3:12 p. m.	0.53	2:56 p. m.	3:12 p. m.	.01	.07	.26	.51	.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	10	10:32 a. m.	1:00 p. m.	1.92	10:45 a. m.	11:11 a. m.	.05	.28	.74	.93	1.26	1.76	1.78	.....	.....	.....	.....	.....	.....	.....	.....
	30	5:00 p. m.	5:45 p. m.	0.67	5:05 p. m.	5:29 p. m.	.02	.10	.28	.41	.53	.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
Key West, Fla.	24	9:00 a. m.	9:40 a. m.	0.90	9:05 a. m.	9:33 a. m.	.01	.07	.26	.52	.68	.76	.88	.....	.....	.....	.....	.....	.....	.....	.....
	28	4:25 a. m.	5:20 a. m.	0.59	4:38 a. m.	5:08 a. m.	.04	.19	.26	.29	.34	.45	.54	.....	.....	.....	.....	.....	.....	.....	.....
Knoxville, Tenn.	4–5	.....	.....	1.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.46	.....	.....	.....
La Crosse, Wis.	18	2:16 a. m.	D. N. a. m.	1.15	3:38 a. m.	3:56 a. m.	.19	.05	.26	.43	.49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lander, Wyo.	27	.....	.....	0.32	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.13	.....	.....	.....
Lansing, Mich.	1	3:13 p. m.	4:30 p. m.	0.65	3:24 p. m.	3:49 p. m.	.02	.06	.15	.35	.48	.57	.....	.....	.....	.....	.....	.....	.....	.....	.....
	18	6:25 p. m.	7:30 p. m.	0.73	6:47 p. m.	7:09 p. m.	.06	.09	.21	.48	.58	.66	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lewiston, Idaho.	16	.....	.....	0.37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.21	.....	.....	.....
Lexington, Ky.	1	3:00 p. m.	8:00 p. m.	1.22	5:46 p. m.	6:01 p. m.	.36	.12	.52	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	7–8	D. N. p. m.	D. N. a. m.	2.09	10:43 p. m.	11:17 p. m.	.03	.15	.49	.70	.87	1.01	1.14	1.21	.....	.....	.....	.....	.....	.....	.....
	6–7	11:00 p. m.	12:25 a. m.	0.62	11:13 p. m.	11:45 p. m.	.02	.18	.23	.29	.44	.47	.54	.58	.....	.....	.....	.....	.....	.....	.....
Lincoln, Nebr.	15–16	8:42 p. m.	1:00 a. m.	1.43	8:55 p. m.	10:01 p. m.	.05	.06	.08	.14	.21	.33	.40	.52	.60	.71	.76	1.01	1.27	.....	.....
	31	3:40 p. m.	5:35 p. m.	0.91	4:02 p. m.	4:38 p. m.	.03	.07	.09	.28	.37	.49	.64	.75	.78	.....	.....	.....	.....	.....	.....
Little Rock, Ark.	8	3:10 p. m.	3:50 p. m.	0.51	3:18 p. m.	3:42 p. m.	.02	.08	.24	.32	.38	.48	.....	.....	.....	.....	.....	.....	.....	.....	.....
Los Angeles, Cal.	‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Louisville, Ky.	30	3:46 p. m.	4:03 p. m.	0.43	3:49 p. m.	3:58 p. m.	.01	.27	.41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ludington, Mich.	27	8:13 p. m.	11:15 p. m.	1.64	9:31 p. m.	11:00 p. m.	.16	.20	.28	.28	.29	.36	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lynchburg, Va.	4	6:20 p. m.	8:40 p. m.	1.39	6:41 p. m.	6:59 p. m.	.02	.45	.76	1.08	1.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Macon, Ga.	1	2:20 p. m.	4:05 p. m.	0.51	2:22 p. m.	2:36 p. m.	.01	.19	.40	.46	.58	.63	.63	.64	.69	.81	1.32	1.47	.....	.....	.....
Madison, Wis.	31	8:25 p. m.	9:30 p. m.	1.59	8:30 p. m.	8:58 p. m.	.02	.15	.38	.67	1.05	1.33	1.38	.....	.....	.....	.....	.....	.....	.....	.....
Marquette, Mich.	11	.....	.....	0.67	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.30	.....	.....	.....
Memphis, Tenn.	17	.....	.....	0.39	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.39	.....	.....	.....
Meridian, Miss.	5	.....	.....	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.32	.....	.....	.....
Miami, Fla.	25	10:45 a. m.	1:50 p. m.	1.10	11:50 a. m.	12:15 p. m.	.14	.09	.40	.71	.81	.91	.....	.....	.....	.....	.....	.....	.....	.....	.....
	27	9:02 p. m.	9:40 p. m.	0.61	9:08 p. m.	9:27 p. m.	.01	.06	.27	.43	.59	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	31	3:26 p. m.	D. N. p. m.	0.99	4:12 p. m.	4:38 p. m.	.12	.06	.23	.37	.43	.50	.53	.....	.....	.....	.....	.....	.....	.....	.....
Milwaukee, Wis.	7	.....	.....	0.86	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.29	.....	.....	.....
Minneapolis, Minn.	14	D. N.	D. N.	2.42	2:28 a. m.	3:38 a. m.	.03	.08	.23	.44	.65	.81	.95	1.01	1.05	1.09	1.20	1.63	2.38	.....	.....
Mobile, Ala.	2–3	9:45 p. m.	12:20 p. m.	3.77	10:40 p. m.	11:02 p. m.	.31	.41	.49	.73	.93	.97	.....	.....	.....	.....	.....	.....	.....	.....	.....
					11:53 p. m.	12:43 a. m.	1.41	.13	.36	.43	.45	.49	.52	.54	.71	.98	1.08	.....	.....	.....	.....
Modena, Utah.	24	7:56 p. m.	D. N. p. m.	0.70	8:34 p. m.	9:05 p. m.	.12	.08	.14	.16	.23	.33	.51	.54	.....	.....	.....	.....	.....	.....	.....
Montgomery Ala.	2	1:00 p. m.	2:25 p. m.	1.01	1:13 p. m.	1:47 p. m.	.04	.16	.39	.55	.71	.81	.87	.91	.....	.....	.....	.....	.....	.....	.....
	5	6:05 a. m.	2:25 p. m.	1.14	6:32 a. m.	7:00 a. m.	.07	.06	.15	.22	.48	.56	.63	.....	.....	.....	.....	.....	.....	.....	.....
		4:20 p. m.	6:10 p. m.	0.56	4:37 p. m.	4:55 p. m.	.01	.17	.36	.47	.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	17	12:15 p. m.	2:10 p. m.	0.61	1:18 p. m.	1:42 p. m.	.03	.14	.31	.47	.53	.58	.....	.....	.....	.....	.....	.....	.....	.....	.....
Moorhead, Minn.	15	3:55 p. m.	5:00 p. m.	0.52	4:00 p. m.	4.17 p. m.	.02	.13	.26	.40	.44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mount Tamalpais, Cal.	4–5	.....	.....	0.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01	.....	.....	.....
Nantucket, Mass.	21	.....	.....	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.16	.....	.....	.....
Nashville, Tenn.	2–3	.....	.....	0.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.38	.....	.....	.....
New Haven, Conn.	5	.....	.....	0.60	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.51	.....	.....	.....
New Orleans, La.	3	6:20 a. m.	11:00 a. m.	2.51	6:25 a. m.	7:14 a. m.	.01	.10	.52	.93	1.22	1.48	1.58	1.68	2.06	2.20	2.29	.....	.....	.....	.....
	19	5:29 p. m.	7:25 p. m.	1.61	5:29 p. m.	6:17 p. m.	.00	.10	.33	.80	1.07	1.17	1.29	1.37	1.46	1.52	1.56	.....	.....	.....	.....
New York, N. Y.	5	7:58 a. m.	10:50 a. m.	0.97	8:05 a. m.	8:30 a. m.	.02	.05	.36	.51	.68	.81	.....	.....	.....	.....	.....	.....	.....	.....	.....
	22	11:55 a. m.	1:25 p. m.	1.06	11:55 a. m.	12:25 p. m.	.00	.21	.48	.57	.61	.64	.67	.....	.....	.....	.....	.....	.....	.....	.....
Norfolk, Va.	20	11:35 a. m.	1:30 p. m.	1.91	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.75*	.....	.....	.....
		7:25 p. m.	9:00 p. m.	1.14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.02*	.....	.....	.....
	29	6:50 p. m.	8:30 p. m.	1.16	7:21 p. m.	7:51 p. m.	.11	.28	.55	.75	.92	.98	1.03	.....	.....	.....	.....	.....	.....	.....	.....
Northfield, Vt.	7–8	.....	.....	1.81	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
North Head, Wash.	13	.....	.....	0.46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.15	.....	.....	.....
North Platte, Nebr.	9–10	11:20 p. m.	D. N. a. m.	1.02	11:34 p. m.	12:23 a. m.	.01	.12	.21	.22	.27	.48	.61	.71	.82	.88	.92	.....	.....	.....	.....
	31–1[1]	11:38 p. m.	D. N. a. m.	1.53	11:43 p. m.	12:33 a. m.	.01	.19	.49	.72	.84	.91	1.06	1.18	1.31	1.36	1.41	.....	.....	.....	.....
Oklahoma, Okla.	4	.....	.....	0.48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.40	.....	.....	.....
Omaha, Nebr.	11–12	11:55 p. m.	3:45 a. m.	2.33	12:25 a. m.	1:55 a. m.	.15	.09	.19	.31	.37	.43	.57	.62	.68	.74	.86	.96	1.37	.....	.....
					3:03 a. m.	3:36 a. m.	1.69	.10	.26	.40	.47	.52	.59	.63	.....	.....	.....	.....	.....	.....	.....
	18	11:15 a. m.	12:30 p. m.	0.79	11:31 a. m.	11:44 a. m.	.01	.26	.68	.76	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oswego, N. Y.	3	4:47 p. m.	9:40 p. m.	1.45	5:17 p. m.	5:32 p. m.	T.	.74	1.21	1.28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Palestine, Tex.	3	5:30 p. m.	7:40 p. m.	2.71	5:32 p. m.	7:22 p. m.	.01	.13	.17	.19	.21	.31	.47	.61	.67	.69	.73	1.25	1.96	2.55	2.70
Parkersburg, W. Va.	31	5:45 p. m.	6:10 p. m.	0.43	5:51 p. m.	6:02 p. m.	.01	.25	.40	.41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pensacola, Fla.	10	2:00 p. m.	3:55 p. m.	0.76	2:17 p. m.	2:39 p. m.	.07	.11	.21	.42	.52	.57	.....	.....	.....	.....	.....	.....	.....	.....	.....
Peoria, Ill.	7	3:25 p. m.	6:10 p. m.	1.25	4:50 p. m.	5:50 p. m.	.08	.21	.27	.41	.63	.71	.83	.88	.92	.98	1.02	1.15	.....	.....	.....
	30	8:27 p. m.	9:20 p. m.	0.80	8:32 p. m.	8:41 p. m.	.01	.42	.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia, Pa.	13	9:35 p. m.	10:40 p. m.	0.70	9:55 p. m.	10:13 p. m.	.09	.26	.41	.48	.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	28–29	8:25 p. m.	1:00 a. m.	1.20	9:28 p. m.	9:58 p. m.	.02	.11	.32	.35	.49	.76	.88	.....	.....	.....	.....	.....	.....	.....	.....
Phoenix, Ariz.	27	8:27 p. m.	10:00 p. m.	0.54	8:57 p. m.	9:13 p. m.	.06	.09	.24	.36	.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pierre, S. Dak.	13	1:03 a. m.	3:55 a. m.	0.78	1:04 a. m.	1:32 a. m.	T.	.08	.22	.32	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburgh, Pa.	2	.....	.....	1.04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.57	.....	.....	.....
Pocatello, Idaho.	9	.....	.....	0.32	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.14	.....	.....	.....
Point Reyes Light, Cal.	5	.....	.....	0.04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01	.....	.....	.....
Port Huron, Mich.	16	1:39 p. m.	2:40 p. m.	0.71	2:00 p. m.	2:20 p. m.	.01	.08	.09	.39	.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portland, Me.	3	1:12 a. m.	9:45 a. m.	3.22	2:29 a. m.	3:24 a. m.	.05	.05	.10	.15	.29	.47	.63	.74	.77	.78	.87	1.06	.....	.....	.....
					6:34 a. m.	7:22 a. m.	1.95	.07	.18	.36	.45	.60	.71	.93	1.03	1.13	1.17	.....	.....	.....	.....
	8	6:34 a. m.	11:25 p. m.	3.66	7:50 p. m.	8:40 p. m.	2.08	.09	.17	.24	.29	.34	.37	.45	.54	.63	.70	.....	.....	.....	.....
Portland, Oreg.	6–7	.....	.....	0.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.27	.....	.....	.....
Providence, R. I.	1	12:10 a. m.	4:45 a. m.	3.36	1:35 a. m.	4:17 a. m.	0.06	.10	.23	.33	.49	.70	.99	1.17	1.26	1.31	1.39	.....	.....	.....	.....
								1.49	1.57	1.74	1.83	1.89	1.96	2.09	2.21	2.25	2.30	.....	.....	.....	.....
								2.36	2.52	2.58	2.62	2.65	2.78	2.92	2.99	3.04	3.06	.....	.....	.....	.....
Pueblo, Colo.	15	5:33 p. m.	6:32 p. m.	0.80	5:52 p. m.	6:21 p. m.	.07	3.10	3.20	3.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
								.15	.34	.51	.63	.72	.78	.....	.....	.....	.....	.....	.....	.....	.....

[1] Aug. 1.

* Self-register not working.

‡ No precipitation occurred during month.

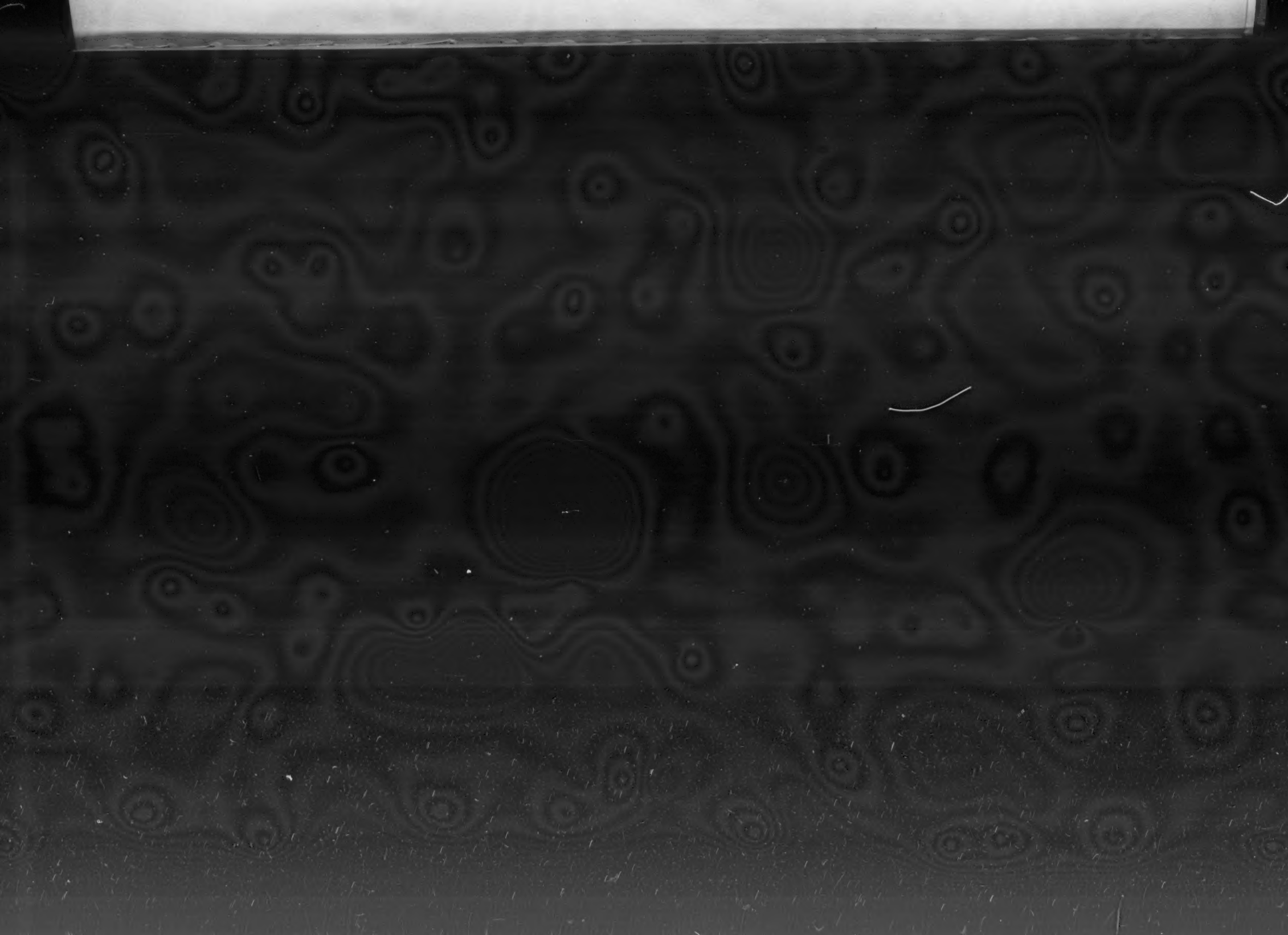


TABLE II.—*Accumulated amounts of precipitation for each 5 minutes, for the principal storms in which the rate of fall equaled or exceeded 0.25 inch in any 5 minutes, or 0.80 in 1 hour, during July, 1915, at all stations furnished with self-registering gages*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive rate began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
Raleigh, N. C.	8	3:03 p. m.	4:55 p. m.	1.25	3:28 p. m.	4:14 p. m.	0.09	0.35	0.52	0.59	0.70	0.70	0.71	0.85	1.04	1.10	1.12	.....	.....	.....	.....
Rapid City, S. Dak.	30	4:16 p. m.	8:40 p. m.	0.95	4:31 p. m.	4:46 p. m.	.02	.25	.49	.59	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Reading, Pa.	8	1:27 p. m.	2:36 p. m.	1.12	1:37 p. m.	2:27 p. m.	.02	.19	.27	.45	.62	.67	.73	.86	.97	1.02	1.08	.....	.....	.....	.....
	26	8:13 p. m.	11:35 p. m.	1.08	8:54 p. m.	9:56 p. m.	.03	.15	.26	.31	.34	.36	.37	.42	.59	.74	.79	0.82	0.96	.....	.....
Red Bluff, Cal.	6	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	T.	.....	.....	.....
Reno, Nev.	2	.....	.....	0.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.02	.....	.....	.....
Richmond, Va.	21	5:01 p. m.	5:40 p. m.	0.81	5:11 p. m.	5:38 p. m.	.02	.06	.20	.42	.60	.77	.79	.....	.....	.....	.....	.....	.....	.....	.....
Rochester, N. Y.	26	.....	.....	0.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.29	.....	.....	.....
Roseburg, Oreg.	6–7	.....	.....	0.49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Roswell, N. Mex.	19–20	.....	.....	0.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.14	.....	.....	.....
Sacramento, Cal.	6	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	T.	.....	.....	.....
Saginaw, Mich.	4	.....	.....	0.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.64	.....	.....	.....
St. Joseph, Mo.	13	4:15 a. m.	8:30 a. m.	2.50	4:21 a. m.	5:25 a. m.	.01	.14	.30	.44	.62	.81	1.07	1.36	1.61	1.82	1.98	2.18	2.29	.....	.....
	18	2:47 p. m.	3:45 p. m.	0.82	2:53 p. m.	3:19 p. m.	.02	.23	.49	.56	.61	.65	.70	.....	.....	.....	.....	.....	.....	.....	.....
	26	4:47 p. m.	6:00 p. m.	0.62	4:50 p. m.	5:06 p. m.	.01	.24	.39	.51	.55	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
		2:55 p. m.	5:45 p. m.	1.68	3:25 p. m.	3:32 p. m.	.01	.50	.59	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
					4:29 p. m.	4:46 p. m.	.86	.18	.52	.70	.77	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo.	7	6:48 a. m.	8:20 a. m.	0.56	6:53 a. m.	7:13 a. m.	.01	.18	.36	.44	.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	18	4:10 p. m.	5:15 p. m.	0.85	4:31 p. m.	5:01 p. m.	.13	.05	.11	.15	.29	.48	.66	.....	.....	.....	.....	.....	.....	.....	.....
		8:40 a. m.	9:05 a. m.	0.62	8:48 a. m.	9:01 a. m.	.06	.11	.42	.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
		2:02 p. m.	5:30 p. m.	0.95	2:55 p. m.	3:17 p. m.	.08	.32	.52	.64	.70	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....
	30	5:40 a. m.	10:25 a. m.	1.65	7:46 a. m.	8:29 a. m.	.58	.13	.28	.45	.50	.54	.62	.65	.83	.90	.....	.....	.....	.....	.....
St. Paul, Minn.	14	3:10 a. m.	4:30 a. m.	1.13	3:15 a. m.	3:58 a. m.	.01	.06	.27	.49	.69	.78	.86	.91	1.03	1.08	.....	.....	.....	.....	.....
Salt Lake City, Utah	5	.....	.....	0.07	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.07	.....	.....	.....
San Antonio, Tex.	4	5:55 a. m.	8:45 a. m.	0.81	6:16 a. m.	6:31 a. m.	.08	.12	.26	.37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Diego, Cal.	10	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	T.	.....	.....	.....
Sand Key, Fla.	23	1:01 a. m.	3:50 a. m.	0.83	2:08 a. m.	2:23 a. m.	.36	.18	.33	.43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sandusky, Ohio	11	D. N. a. m.	10:20 a. m.	1.06	8:26 a. m.	9:11 a. m.	.25	.05	.11	.26	.35	.47	.51	.55	.62	.69	.....	.....	.....	.....	.....
San Francisco, Cal.	4	.....	.....	0.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01	.....	.....	.....
San Jose, Cal.	‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Luis Obispo, Cal.	5	.....	.....	0.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01	.....	.....	.....
Santa Fe, N. Mex.	3	.....	.....	0.67	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.54	.....	.....	.....
Sault Ste. Marie, Mich.	4–5	.....	.....	1.21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Savannah, Ga.	4	2:00 p. m.	4:00 p. m.	0.61	2:36 p. m.	2:56 p. m.	.01	.22	.33	.49	.58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	6	4:50 p. m.	6:05 p. m.	1.54	4:52 p. m.	5:25 p. m.	.01	.18	.53	.96	1.26	1.37	1.45	1.50	.....	.....	.....	.....	.....	.....	.....
	9	11:37 a. m.	12:10 p. m.	0.52	11:42 a. m.	11:56 a. m.	.01	.23	.38	.51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	9	3:52 p. m.	5:05 p. m.	0.98	3:54 p. m.	4:29 p. m.	.01	.09	.15	.23	.27	.53	.75	.87	.....	.....	.....	.....	.....	.....	.....
	10	2:57 p. m.	7:05 p. m.	1.39	3:13 p. m.	3:34 p. m.	.07	.13	.41	.68	1.01	1.05	.....	.....	.....	.....	.....	.....	.....	.....	.....
Scranton, Pa.	19	.....	.....	0.36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.32	.....	.....	.....
Seattle, Wash.	13–14	.....	.....	0.47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.37	.....	.....	.....
Sheridan, Wyo.	31	3:20 p. m.	5:00 p. m.	0.72	4:40 p. m.	4:53 p. m.	.17	.15	.43	.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shreveport, La.	4	.....	.....	2.10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.69	.....	.....	.....
Sioux City, Iowa	6–7	10:10 p. m.	1:00 a. m.	1.34	10:39 p. m.	10:56 p. m.	.03	.11	.52	.82	.89	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	17–18	10:45 p. m.	12:30 a. m.	1.72	11:06 p. m.	12:03 a. m.	.03	.19	.34	.38	.51	.57	.67	.95	1.25	1.49	1.58	1.69	.....	.....	.....
Spokane, Wash.	9	.....	.....	0.26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.26	.....	.....	.....
Springfield, Ill.	30–31	10:19 p. m.	D. N. a. m.	2.07	10:21 p. m.	11:39 p. m.	.01	.20	.38	.38	.39	.39	.40	.46	.72	.90	1.13	1.25	1.81	.....	.....
Springfield, Mo.	18–19	8:50 p. m.	D. N. a. m.	0.66	9:00 p. m.	9:17 p. m.	.01	.12	.30	.43	.48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Syracuse, N. Y.	2	5:05 p. m.	8:45 p. m.	2.63	5:09 p. m.	7:09 p. m.	T.	.24	.48	.65	.79	.95	1.02	1.23	1.28	1.29	1.29	1.32	1.96	2.27	2.48
	13	1:32 p. m.	3:00 p. m.	1.13	1:58 p. m.	2:22 p. m.	.03	.30	.52	.78	.89	1.01	.....	.....	.....	.....	.....	.....	.....	.....	.....
		6:10 p. m.	7:25 p. m.	0.67	6:36 p. m.	7:01 p. m.	.02	.15	.34	.48	.54	.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tacoma, Wash.	16	.....	.....	0.23	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.21	.....	.....	.....
Tampa, Fla.	21	D. N. a. m.	D. N. a. m.	0.85	1:11 a. m.	2:11 a. m.	.01	.09	.18	.25	.32	.41	.45	.46	.50	.59	.69	.80	.....	.....	.....
	22–23	D. N. p. m.	1:15 p. m.	1.41	10:56 a. m.	11:27 a. m.	.65	.08	.15	.18	.24	.52	.62	.64	.....	.....	.....	.....	.....	.....	.....
	31	1:13 p. m.	2:03 p. m.	0.65	1:13 p. m.	1:36 p. m.	.00	.05	.30	.49	.59	.63	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tatoosh Island, Wash.	7–8	.....	.....	0.43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.14	.....	.....	.....
Taylor, Tex.	27	8:01 a. m.	10:10 a. m.	0.83	8:01 a. m.	8:46 a. m.	.00	.05	.09	.17	.28	.40	.46	.54	.69	.78	.....	.....	.....	.....	.....
Terre Haute, Ind.	7	2:30 p. m.	8:30 p. m.	3.46	5:03 p. m.	6:14 p. m.	.49	1.05	1.32	1.38	1.56	1.70	1.80	1.98	2.18	2.38	2.46	2.57	2.94	.....	.....
	28	3:20 p. m.	4:28 p. m.	0.78	3:39 p. m.	4:09 p. m.	.01	.21	.24	.28	.44	.61	.71	.....	.....	.....	.....	.....	.....	.....	.....
Thomasville, Ga.	2	8:10 a. m.	8:53 a. m.	0.94	8:19 a. m.	8:39 a. m.	.01	.16	.44	.77	.91	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	3	11:26 a. m.	1:42 p. m.	0.81	11:33 a. m.	11:47 a. m.	.01	.26	.58	.66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Toledo, Ohio	28	5:56 a. m.	6:17 a. m.	0.76	5:58 a. m.	6:10 a. m.	.01	.45	.70	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	31	1:10 p. m.	2:12 p. m.	0.70	1:19 p. m.	1:48 p. m.	.01	.09	.24	.41	.47	.53	.59	.....	.....	.....	.....	.....	.....	.....	.....
Tonopah, Nev.	22	.....	.....	0.15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.10	.....	.....	.....
Topeka, Kans.	13	2:17 a. m.	9:45 a. m.	1.27	2:20 a. m.	2:32 a. m.	.01	.37	.49	.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	14	8:21 p. m.	11:00 p. m.	1.08	8:31 p. m.	9:08 p. m.	.04	.07	.11	.25	.56	.63	.67	.75	.83	.....	.....	.....	.....	.....	.....
	18	3:17 p. m.	5:40 p. m.	1.34	3:30 p. m.	4:16 p. m.	.01	.14	.26	.33	.37	.42	.47	.58	.68	.76	.79	.....	.....	.....	.....
Valentine, Nebr.	6–7	5:12 p. m.	7:40 a. m.	4.02	5:44 p. m.	6:29 p. m.	.02	.10	.30	.57	1.19	1.94	2.44	2.62	2.74	2.79	.....	.....	.....	.....	.....
	24	11:43 a. m.	2:05 p. m.	1.25	11:54 a. m.	12:24 p. m.	T.	.05	.19	.57	.80	1.14	1.19	.....	.....	.....	.....	.....	.....	.....	.....
	30	9:24 p. m.	11:35 p. m.	0.79	9:50 p. m.	10:15 p. m.	.16	.07	.16	.32	.42	.53	.....	.....	.....	.....	.....	.....	.....	.....	.....
Vicksburg, Miss.	2	.....	.....	0.74	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.21	.....	.....	.....
Walla Walla, Wash.	29	.....	.....	0.26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.09	.....	.....	.....
Washington, D. C.	16	3:35 p. m.	5:35 p. m.	0.77	3:39 p. m.	3:58 p. m.	.03	.24	.49	.64	.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	19	2:13 p. m.	3:50 p. m.	1.14	2:29 p. m.	3:14 p. m.	.05	.10	.12	.23	.38	.47	.51	.64	.86	1.06	.....	.....	.....	.....	.....
Wichita, Kans.	19	3:08 a. m.	D. N. a. m.	1.09	3:19 a. m.	4:20 a. m.	.01	.17	.32	.44	.57	.70	.78	.83	.88	.93	.99	1.03	.....	.....	.....
	30–31	10:45 p. m.	5:50 a. m.	1.19	11:20 p. m.	11:57 p. m.	.03	.09	.28	.49	.61	.69	.76	.84	.88	.....	.....	.....	.....	.....	.....
Williston, N. Dak.	10	.....	.....	0.64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.30	.....	.....	.....
Wilmington, N. C.	8–9	7:56 p. m.	D. N. a. m.	2.44	1:07 a. m.	1:38 a. m.	1.86	.10	.15	.18	.31	.42	.51	.....	.....	.....	.....	.....	.....	.....	.....
					7:58 p. m.	8:39 p. m.	.01	.07	.14	.28	.43	.51	.60	.74	.85	.88	.....	.....	.....	.....	.....
					11:18 p. m.	11:30 p. m.	1.29	.32	.49	.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	19	12:03 p. m.	12:55 p. m.	0.61	12:06 p. m.	12:27 p. m.	.01	.20	.36	.46	.58	.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
	20–21	8:02 p. m.	D. N. a. m.	2.42	8:02 p. m.	8:29 p. m.	.00	.21	.42	.61	.67	.69	.74	.76	.....	.....	.....	.....	.....	.....	.....
					9:23 p. m.	9:49 p. m.	.75	.12	.43	.64	.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Winnemucca, Nev.	6	.....	.....	0.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.02	.....	.....	.....
Wytheville, Va.	4–5	8:05 p. m.	5:55 a. m.	0.85	2:45 a. m.	2:55 a. m.	.36	.22	.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Yankton, S. Dak.	10	2:25 a. m.	4:40 a. m.	1.04	2:28 a. m.	3:03 a. m.	.01	.35	.47	.51	.59	.72	.82	.....	.....	.....	.....	.....	.....	.....	.....
	14	6:10 a. m.	9:15 a. m.	1.86	6:15 a. m.	6:49 a. m.	.02	.75	1.01	1.22	1.37	1.47	1.51	.....	.....	.....	.....	.....	.....	.....	.....
	15	2:50 p. m.	4:45 p. m.	0.66	3:00 p. m.	3:13 p. m.	.01	.49	.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	17	9:20 p. m.	9:55 p. m.	0.90	9:22 p. m.	9:45 p. m.	.01	.31	.48	.69	.87	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Yellowstone Park, Wyo.	26	.....	.....	0.20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.20	.....	.....	.....

* Self-register not working. † Record partly estimated. ‡ No precipitation occurred during month.

TABLE III.—*Data furnished by the Canadian Meteorological Service, July, 1915.*

Stations.	Pressure.			Temperature.						Precipitation.		
	Station reduced to mean of 24 hours.	Sea-level reduced to mean of 24 hours.	Departure from normal.	Mean max.+mean min.÷2.	Departure from normal.	Mean maximum.	Mean minimum.	Highest.	Lowest.	Total.	Departure from normal.	Total snowfall.
	Inches.	*Inches.*	*Inches.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	*Inches.*	*Inches.*	*Inches.*
St. Johns, N. F.	29.85	29.99	+0.02	56.1	−3.2	63.8	48.2	79	39	3.09	+0.80	.....
Sydney, C. B. I.	29.91	29.95	+ .02	61.4	−0.9	71.4	51.5	79	44	3.44	−0.21	.....
Halifax, N. S.	29.84	29.94	− .02	63.5	+0.1	72.8	54.2	84	48	3.23	−0.82	.....
Yarmouth, N. S.	29.86	29.93	− .02	60.2	+0.7	67.8	52.6	77	44	1.28	−2.34	.....
Charlottetown, P. E. I.	29.88	29.92	+ .02	64.2	+0.1	72.5	55.9	81	48	2.16	−1.33	.....
Chatham, N. B.	29.88	29.90	+ .02	65.0	0.0	75.9	54.0	86	46	5.81	+1.62	.....
Father Point, Que.	29.84	29.86	+ .01	58.2	+0.6	66.7	49.7	85	44	2.52	−0.52	.....
Quebec, Que.	29.59	29.91	.00	66.0	+0.5	77.0	55.1	88	50	1.43	−2.83	.....
Montreal, Que.	29.69	29.89	− .04	69.6	+1.1	78.4	60.9	90	55	1.01	−3.28	.....
Stonecliffe, Ont.	29.32	29.92	− .02	64.8	−0.8	78.9	50.8	90	42	0.76	−2.36	.....
Ottawa, Ont.	29.64	29.96	+ .02	67.6	−1.9	77.6	57.6	88	50	2.07	−1.40	.....
Kingston, Ont.	29.62	29.92	− .05	67.3	−0.9	75.4	59.2	83	52	3.61	+0.72	.....
Toronto, Ont.	29.52	29.88	− .09	68.4	+0.4	77.5	59.3	86	51	4.50	+1.58	.....
White River, Ont.	28.62	29.92	− .02	56.0	−3.5	72.0	39.9	84	30	2.79	−0.01	.....
Port Stanley, Ont.	29.31	29.94	− .04	66.8	−1.0	75.0	58.6	83	46	4.03	+0.99	.....
Southampton, Ont.	29.25	.....	.....	63.9	−0.8	71.9	55.9	83	46	2.31	+1.33	.....
Parry Sound, Ont.	29.24	29.92	− .04	65.6	−0.4	76.8	54.5	86	48	2.22	−0.40	.....
Port Arthur, Ont.	29.25	29.96	+ .02	60.5	−1.5	70.0	51.0	84	41	2.86	−0.62	.....
Winnipeg, Man.	29.12	29.94	+ .01	62.8	−3.2	74.1	51.5	86	38	1.83	−1.25	.....
Minnedosa, Man.	28.17	29.96	+ .03	59.6	−2.6	70.7	48.4	82	38	2.66	+0.06	.....
Qu'Appelle, Sask.	27.71	29.94	+ .02	58.3	−5.2	69.5	47.1	84	34	2.81	+0.33	.....
Medicine Hat, Alberta.	27.67	29.91	+ .01	61.2	−6.6	77.8	52.5	90	43	3.58	+1.49	.....
Swift Current, Sask.	27.39	29.93	+ .02	60.0	−6.5	71.3	45.7	86	36	2.37	−0.07	.....
Calgary, Alberta.	26.39	29.86	− .04	58.8	−1.8	70.6	47.1	81	38	3.98	+1.30	.....
Banff, Alberta.	25.44	29.97	+ .07	54.6	−2.0	66.1	43.1	79	35	3.96	+0.72	.....
Edmonton, Alberta.	27.69	29.96	+ .06	58.5	−2.1	69.5	47.5	78	37	4.24	+1.21	.....
Prince Albert, Sask.	28.38	29.92	+ .01	58.4	−3.5	67.5	49.3	78	40	3.17	+1.12	.....
Battleford, Sask.	28.25	29.97	+ .07	62.2	−2.5	74.2	50.3	85	40	3.18	+0.84	.....
Kamloops, B. C.	28.71	29.97	+ .03	68.6	+0.1	81.2	55.9	94	46	1.15	−0.46	.....
Victoria, B. C.	29.75	30.00	− .05	59.9	−0.1	67.2	52.6	87	50	0.84	+0.44	.....
Barkerville, B. C.	25.65	29.90	− .01	54.0	−1.1	65.5	42.5	74	32	4.90	+1.88	.....
Hamilton, Bermuda.	30.00	30.16	+ .02	77.8	−0.9	82.8	72.7	85	69	4.42	−0.02	.....

Chart I. Hydrographs of Several Principal Rivers, July, 1915. XLIII–64.

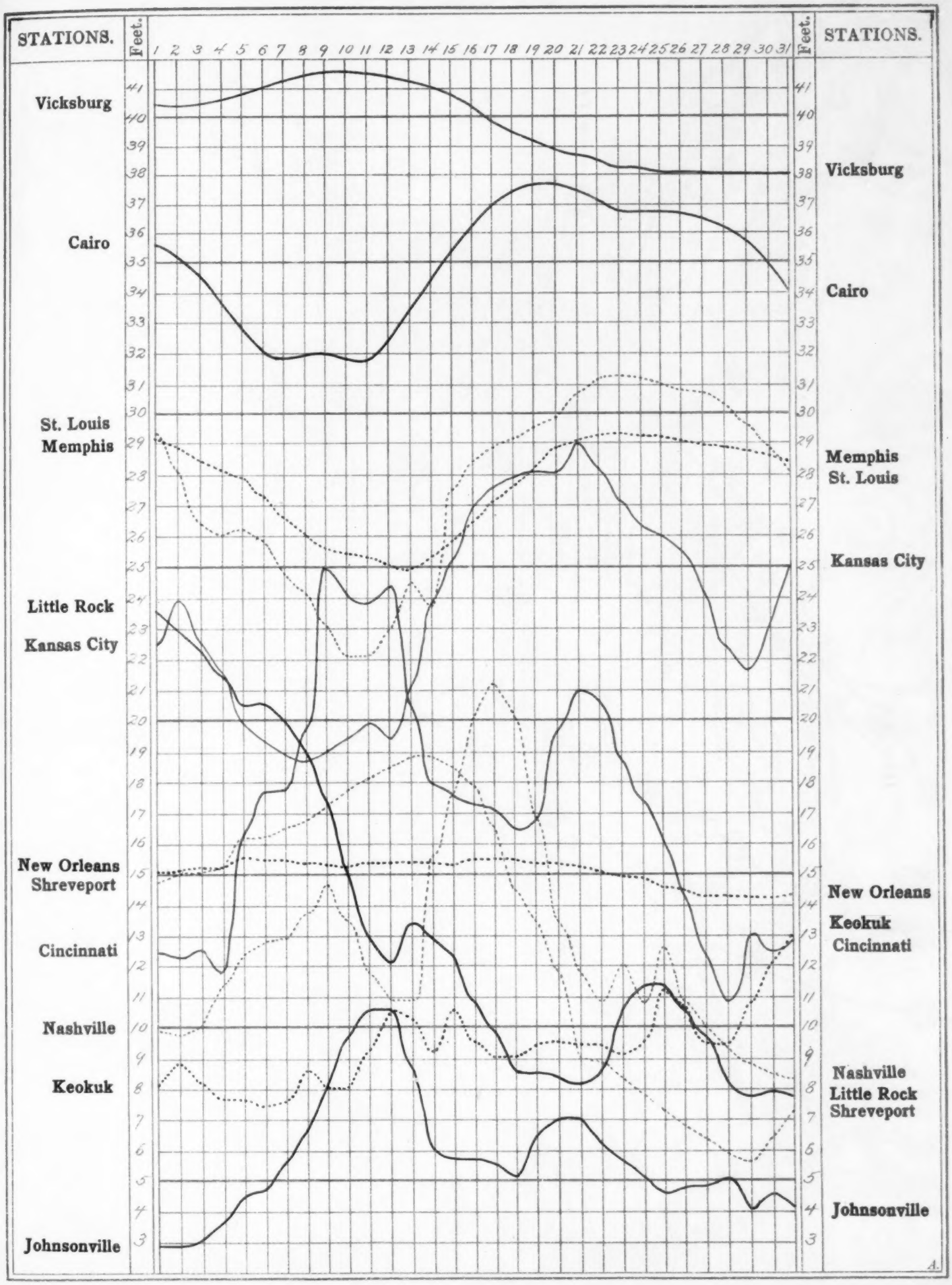


Chart II. Tracks of Centers of High Areas, July, 1915.

(Plotted by R. H. Weightman.)

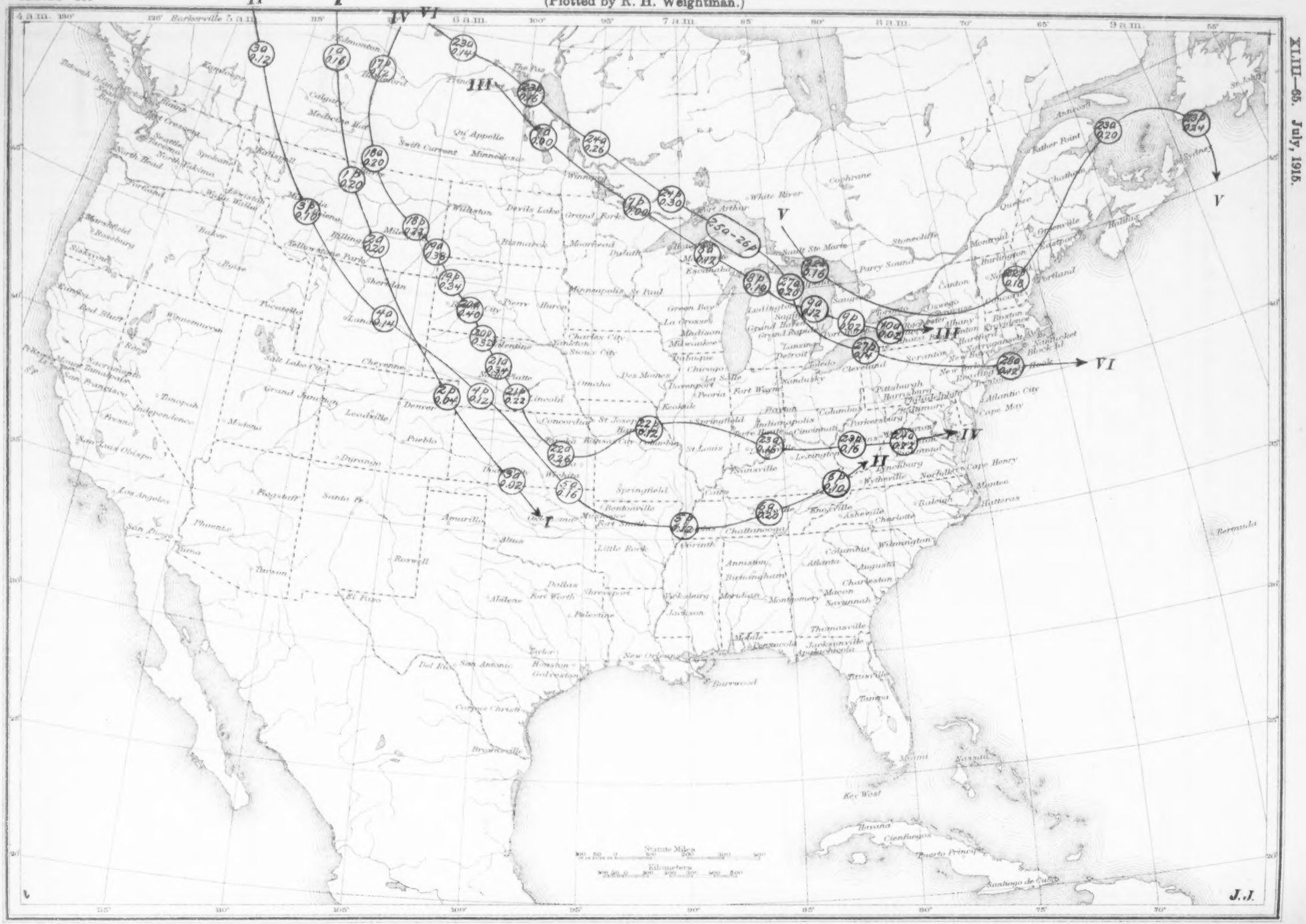


Chart III. Tracks of Centers of Low Areas, July, 1915.

(Plotted by R. H. Weightman.)

Chart III. Tracks of Centers of Low Areas, July, 1915.
(Plotted by R. H. Weightman.)

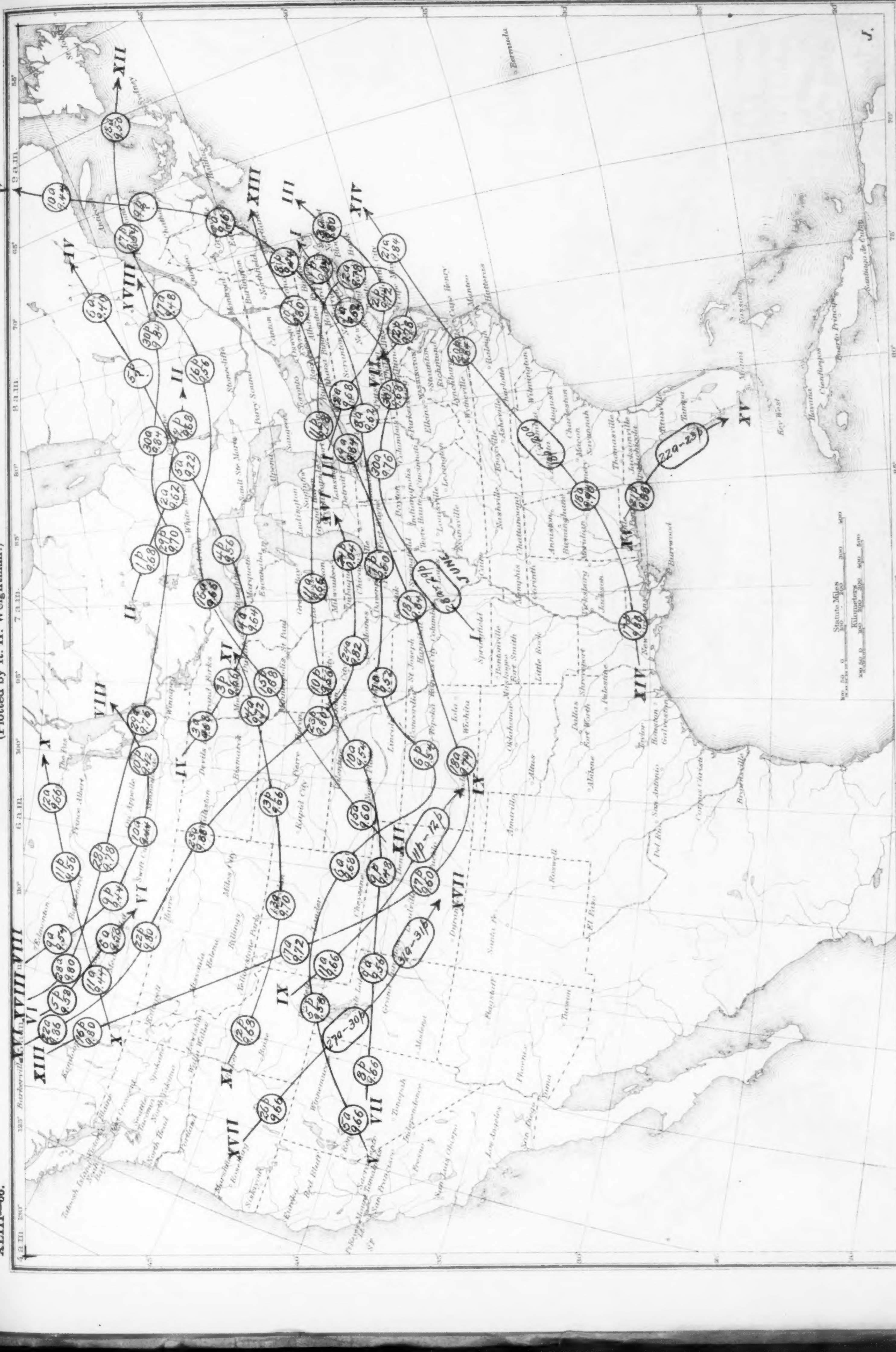


Chart IV. Departure (°F.) of the Mean Temperature from the Normal, July, 1915.

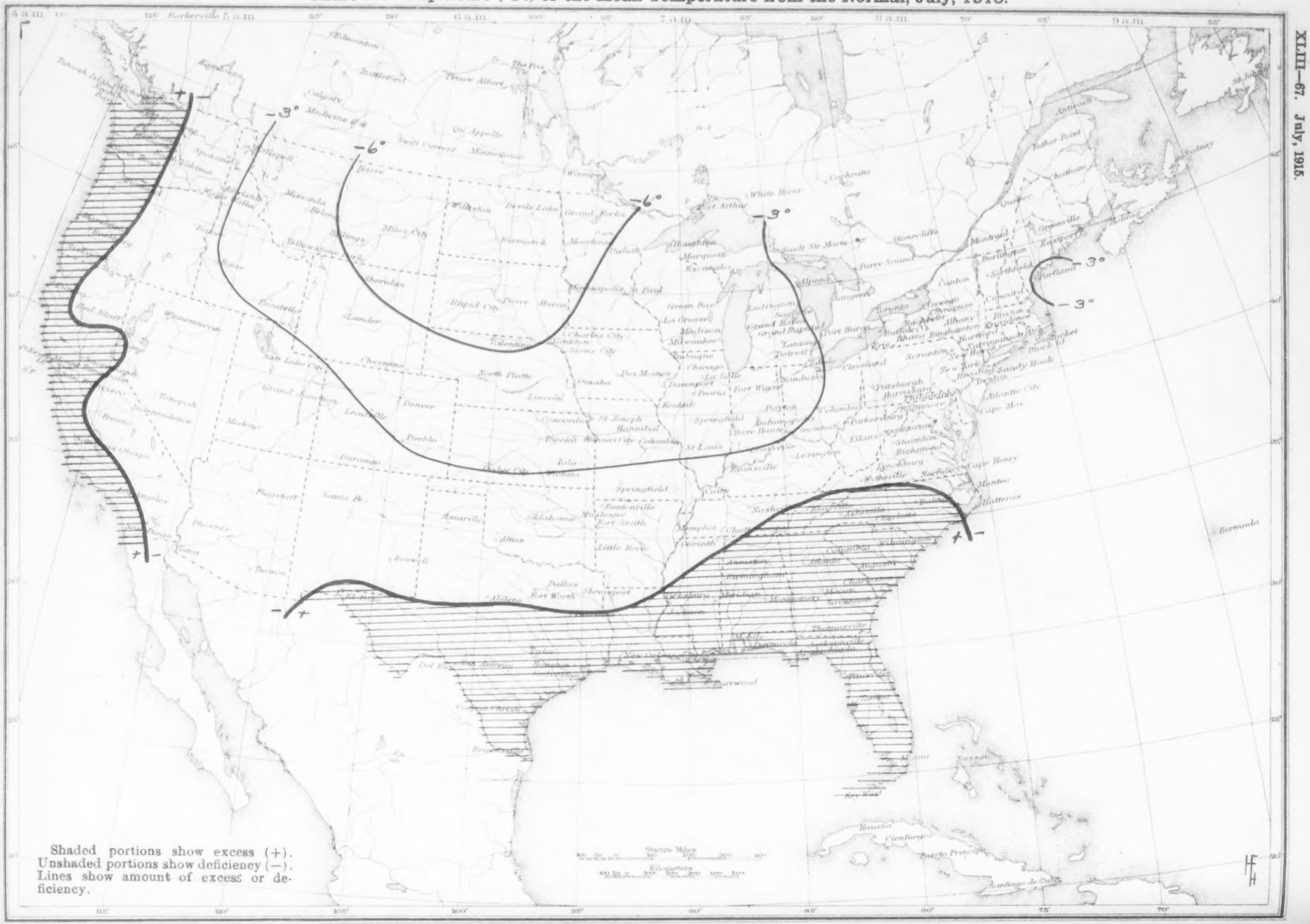


Chart V. Total Precipitation, Inches, July, 1915.

Chart V. Total Precipitation, Inches, July, 1915.

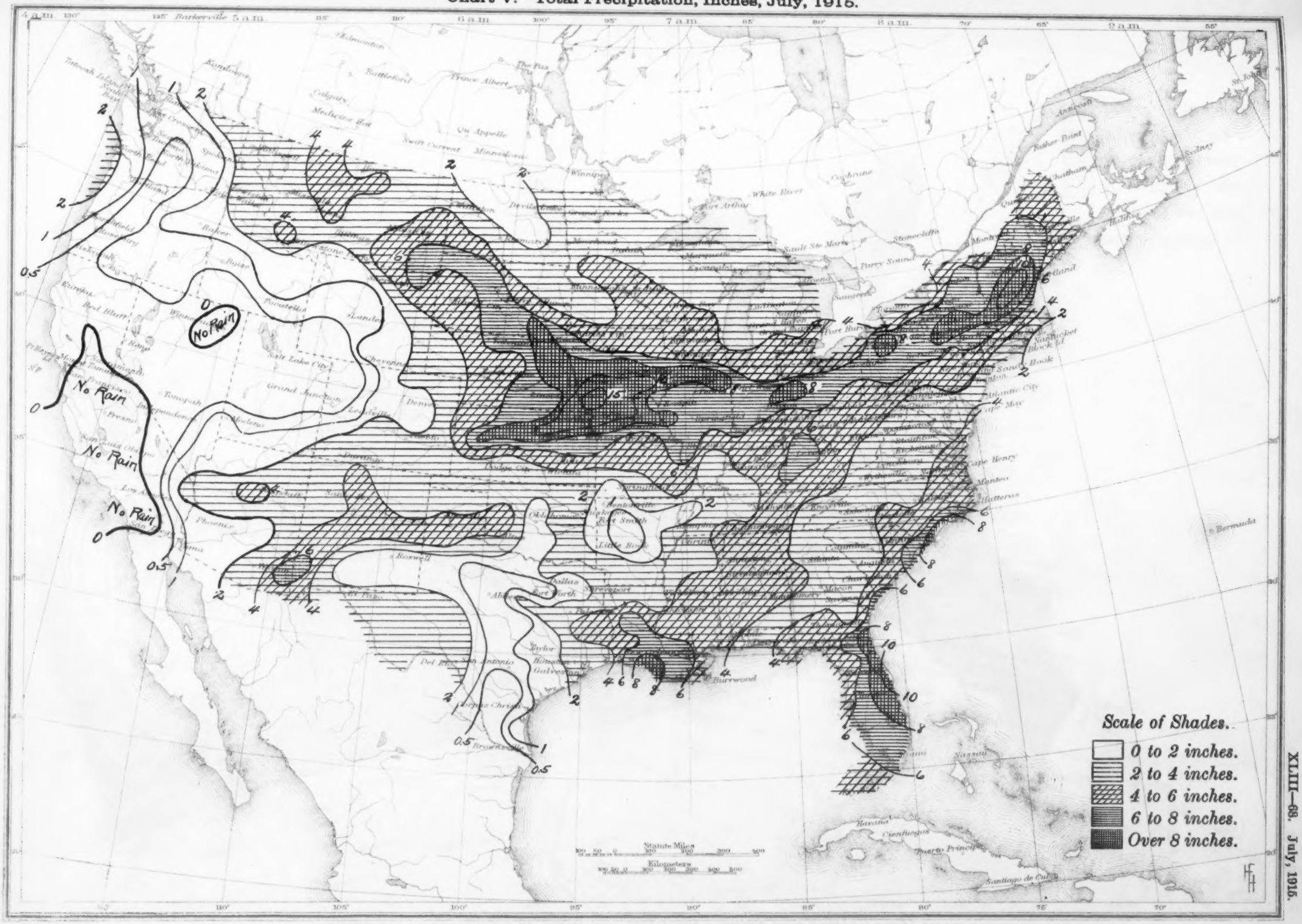


Chart VI. Percentage of Clear Sky between Sunrise and Sunset, July, 1915.

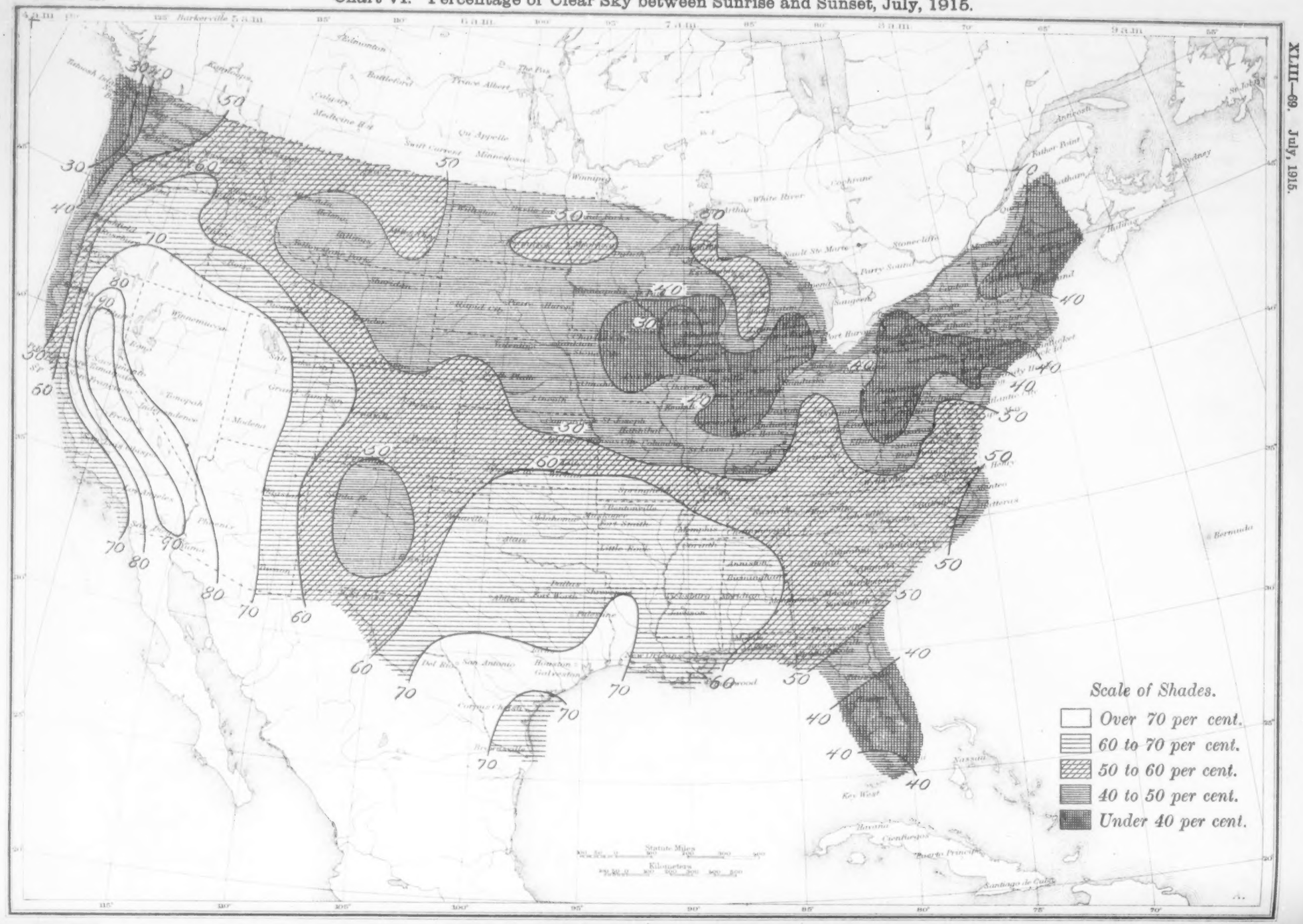
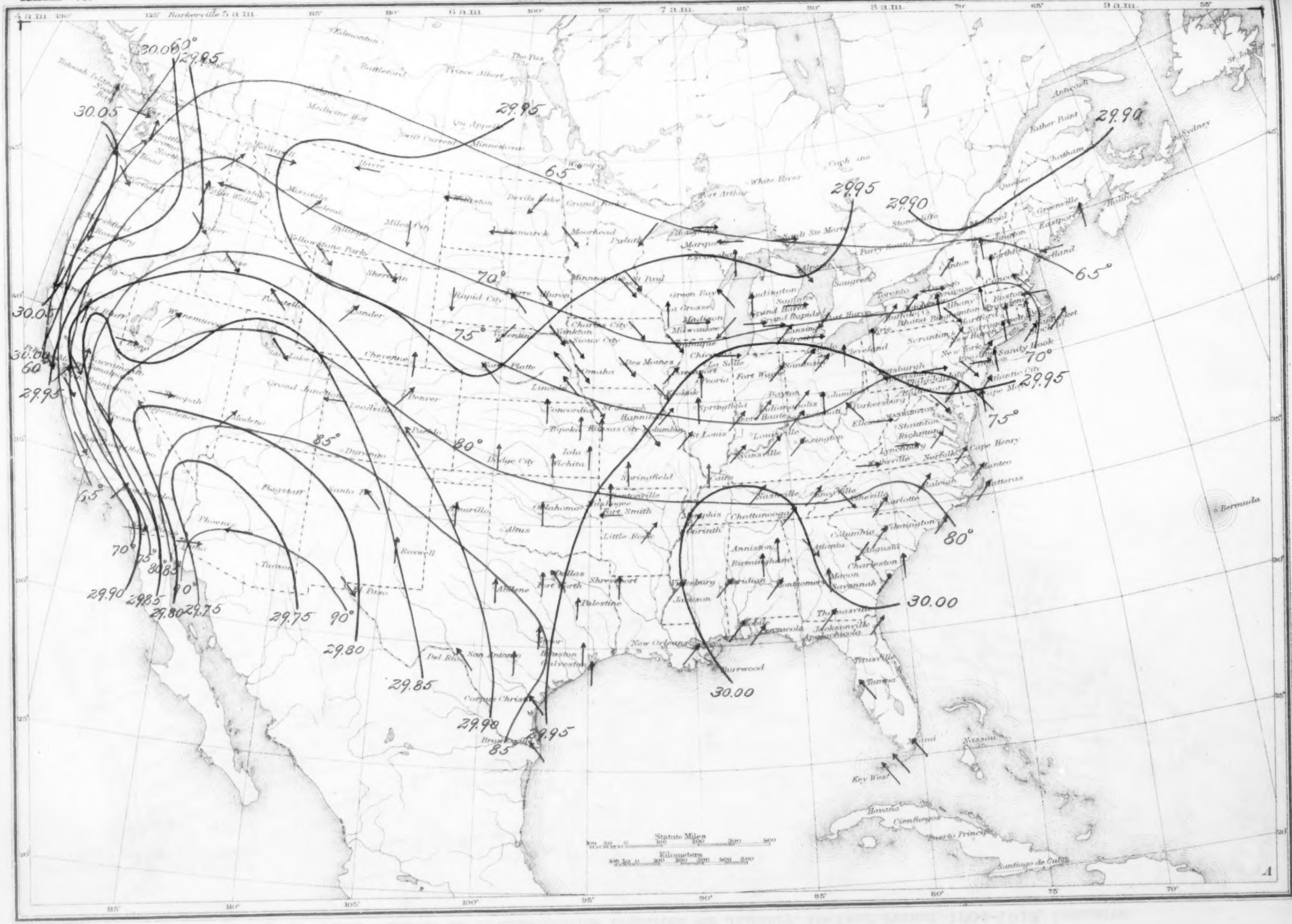
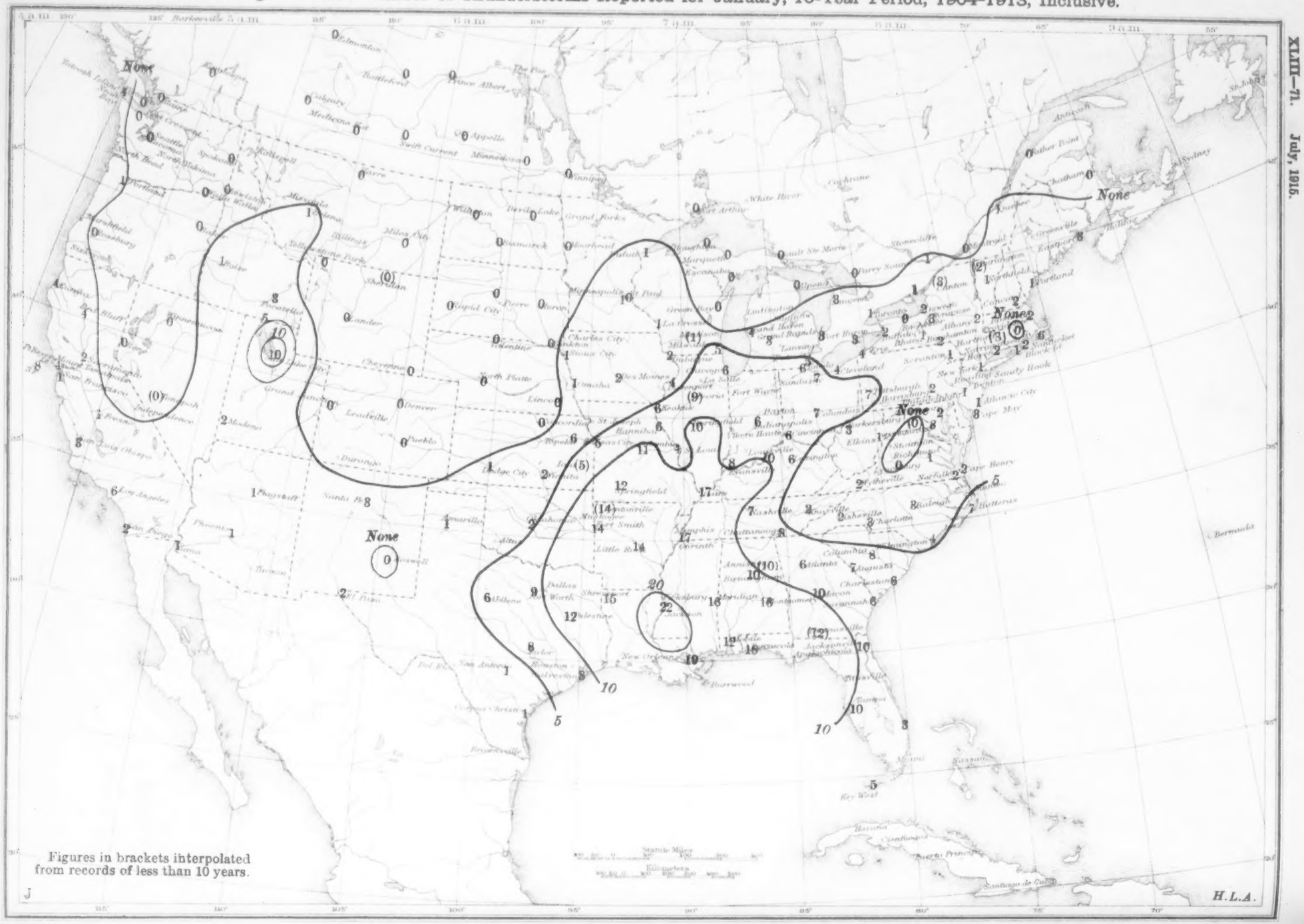


Chart VII. Isobars and Isotherms at Sea Level; Prevailing Winds, July, 1915.

Chart VII. Isobars and Isotherms at Sea Level; Prevailing Winds, July, 1915.

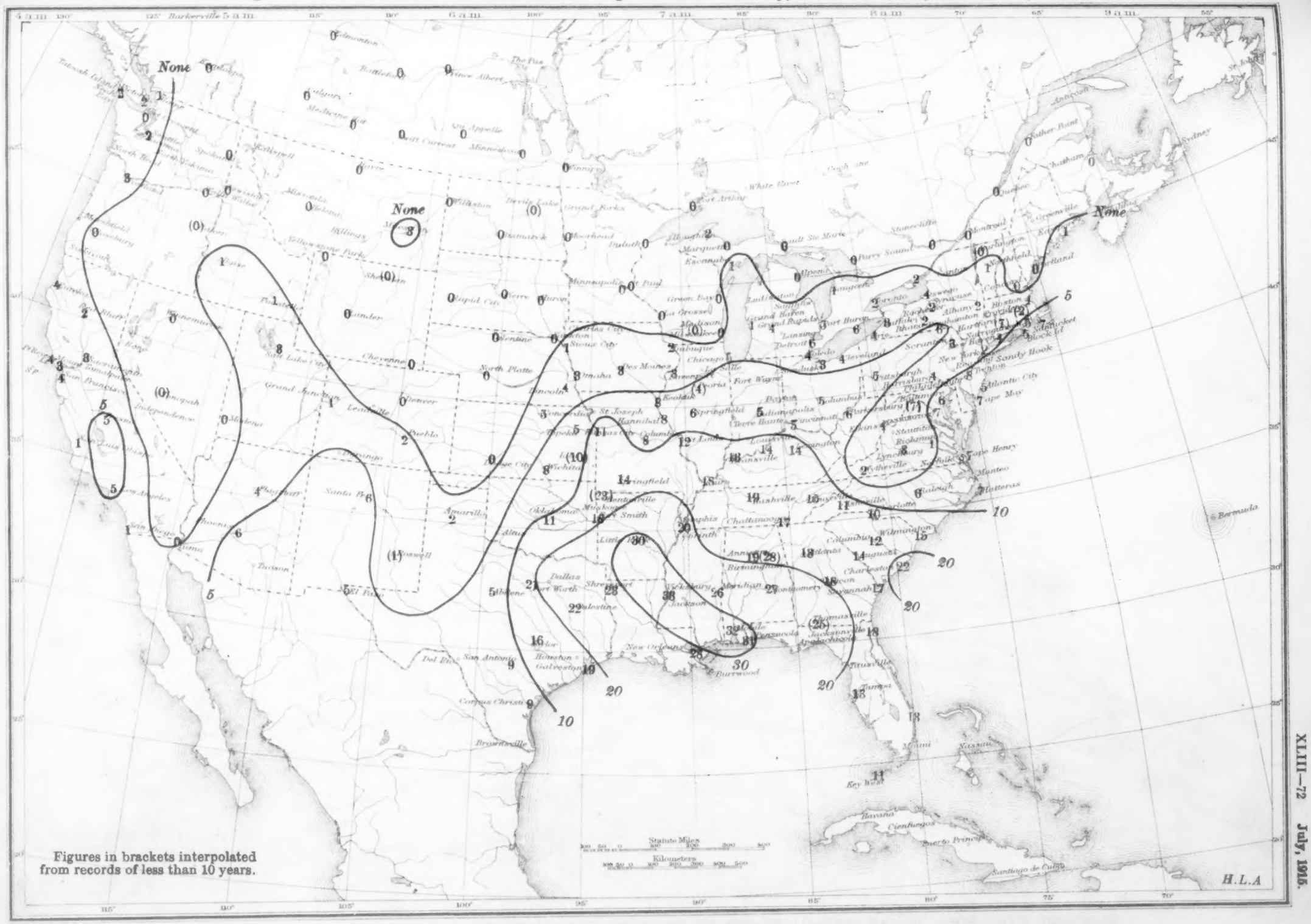


W. H. A. **Fig. 1. Total Number of Thunderstorms Reported for January, 10-Year Period, 1904–1913, Inclusive.**

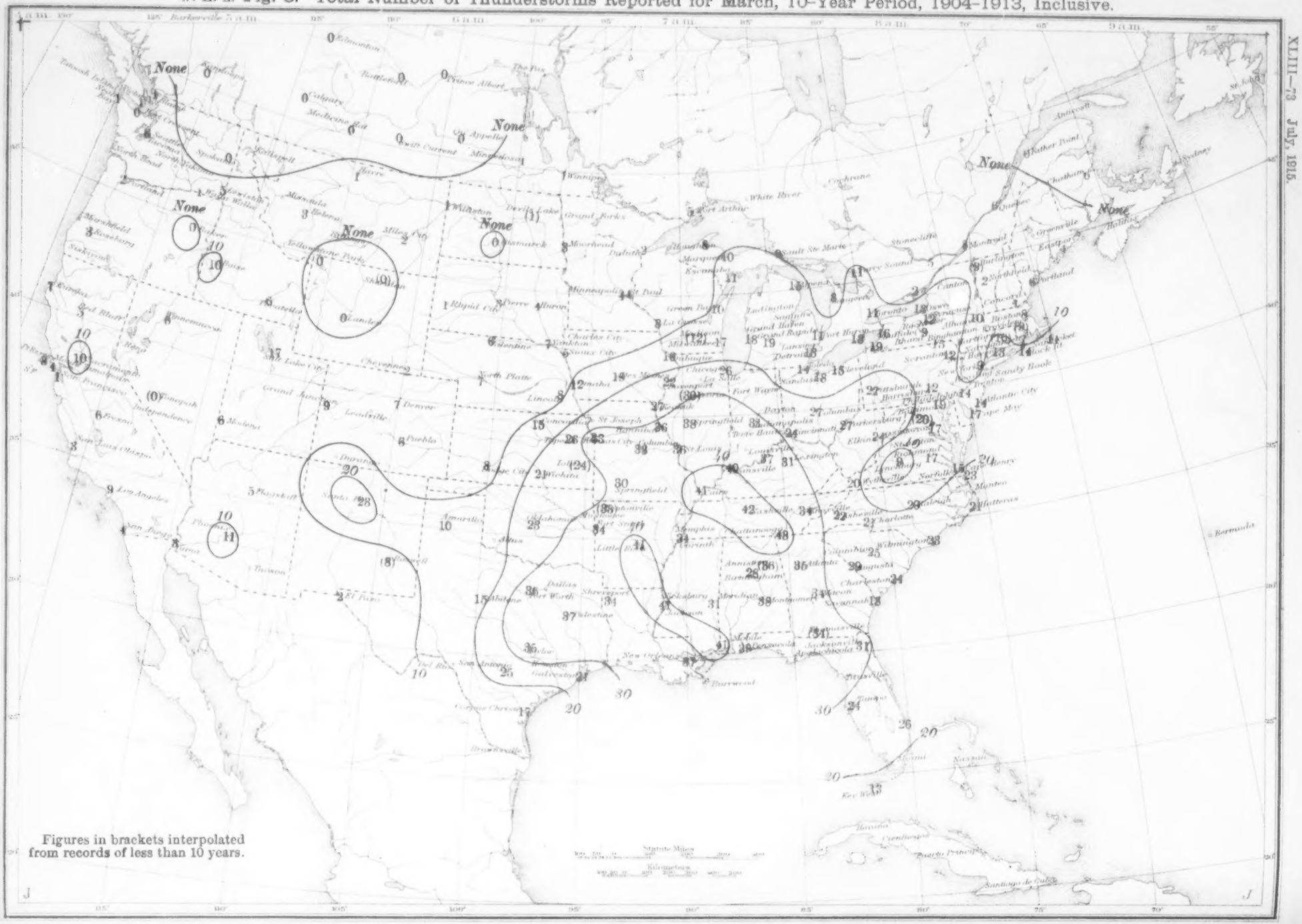


W. H. A. **Fig. 2. Total Number of Thunderstorms Reported for February, 10-Year Period, 1904–1913, Inclusive.**

W. H. A. **Fig. 2. Total Number of Thunderstorms Reported for February, 10-Year Period, 1904–1913, Inclusive.**

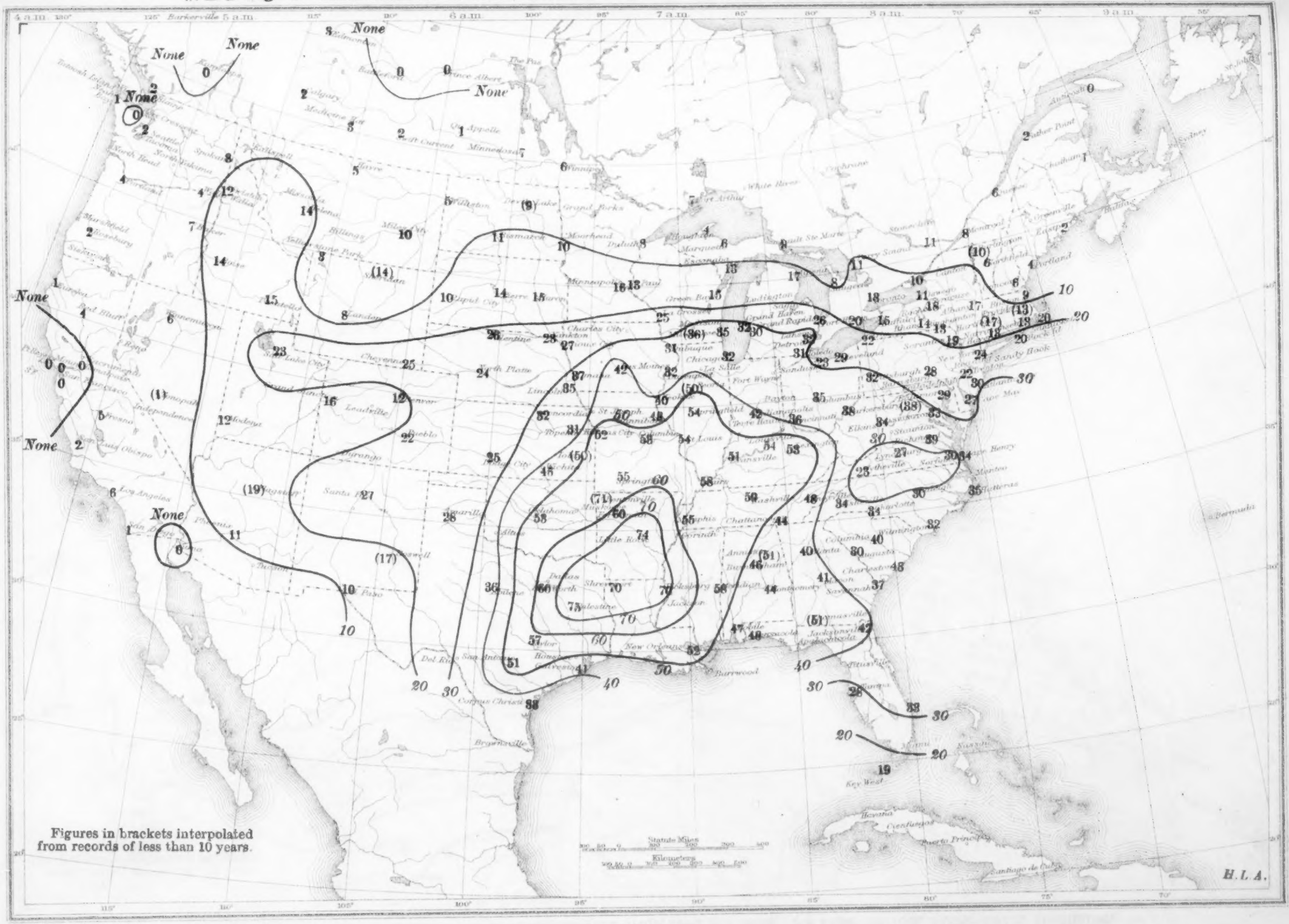


W. H. A. **Fig. 3. Total Number of Thunderstorms Reported for March, 10-Year Period, 1904–1913, Inclusive.**

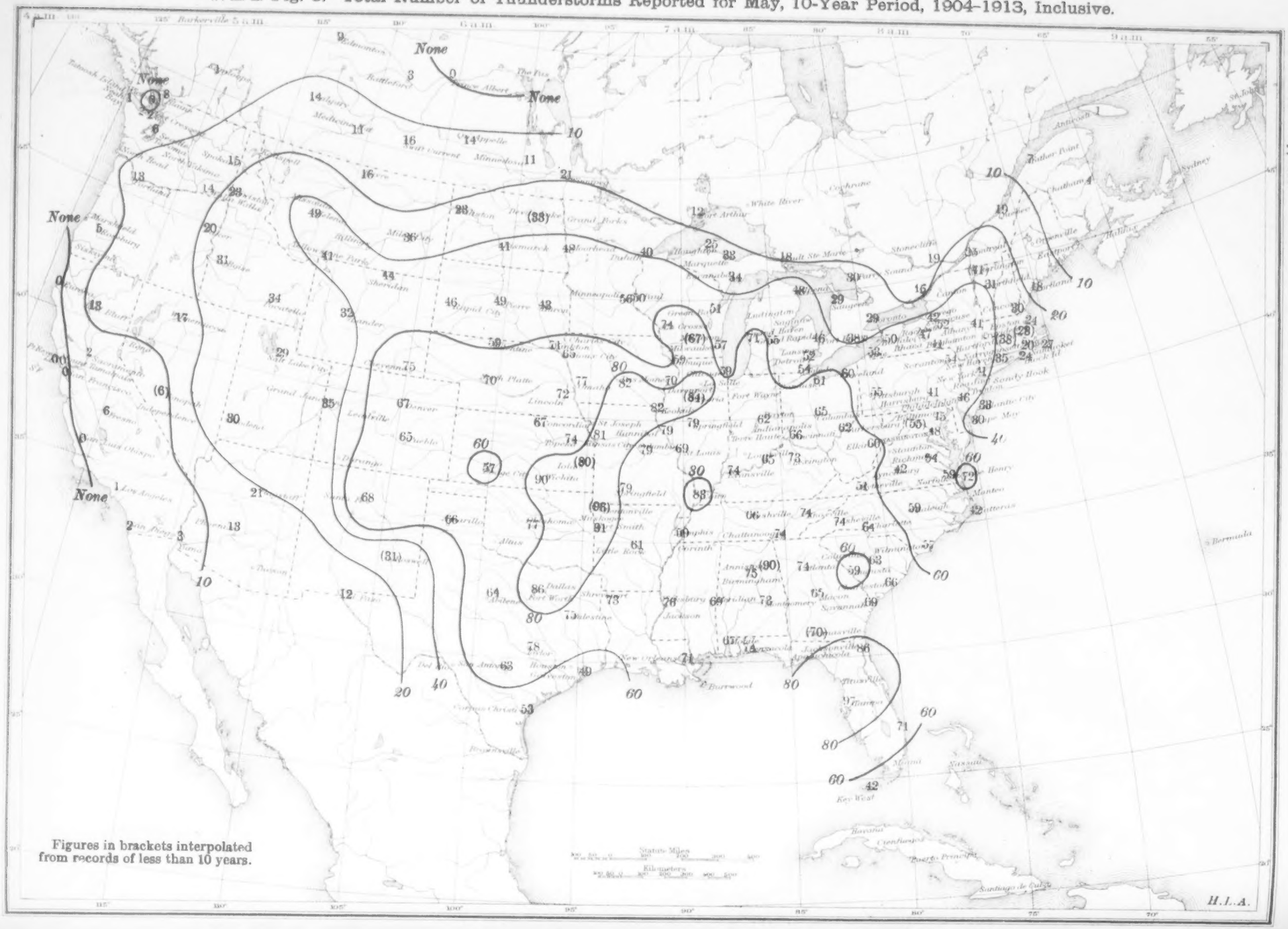


W. H. A. **Fig. 4. Total Number of Thunderstorms Reported for April, 10-Year Period, 1904–1913, Inclusive.**

W. H. A. **Fig. 4. Total Number of Thunderstorms Reported for April, 10-Year Period, 1904–1913, Inclusive.**

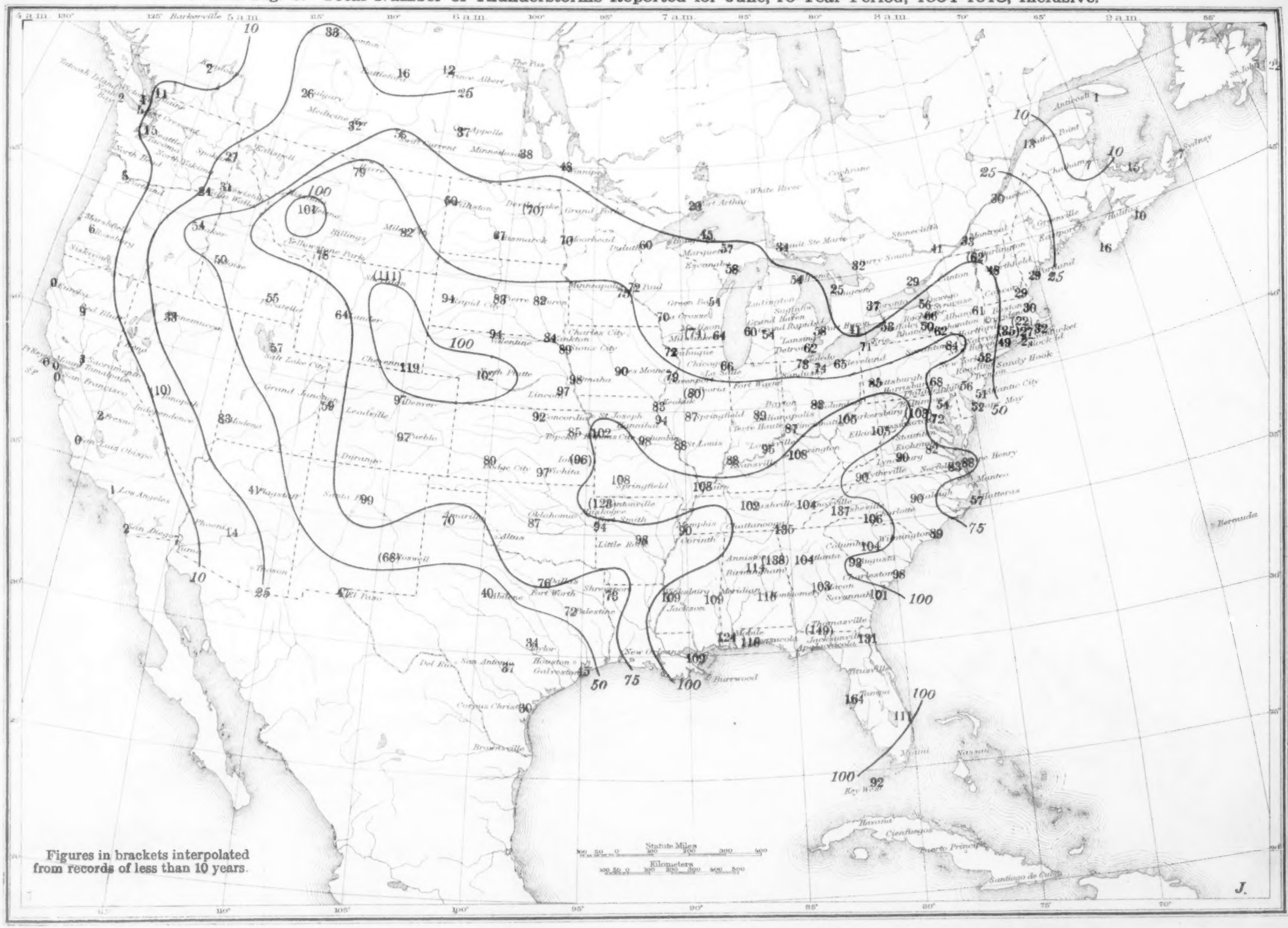


W. H. A. Fig. 5. Total Number of Thunderstorms Reported for May, 10-Year Period, 1904–1913, Inclusive.

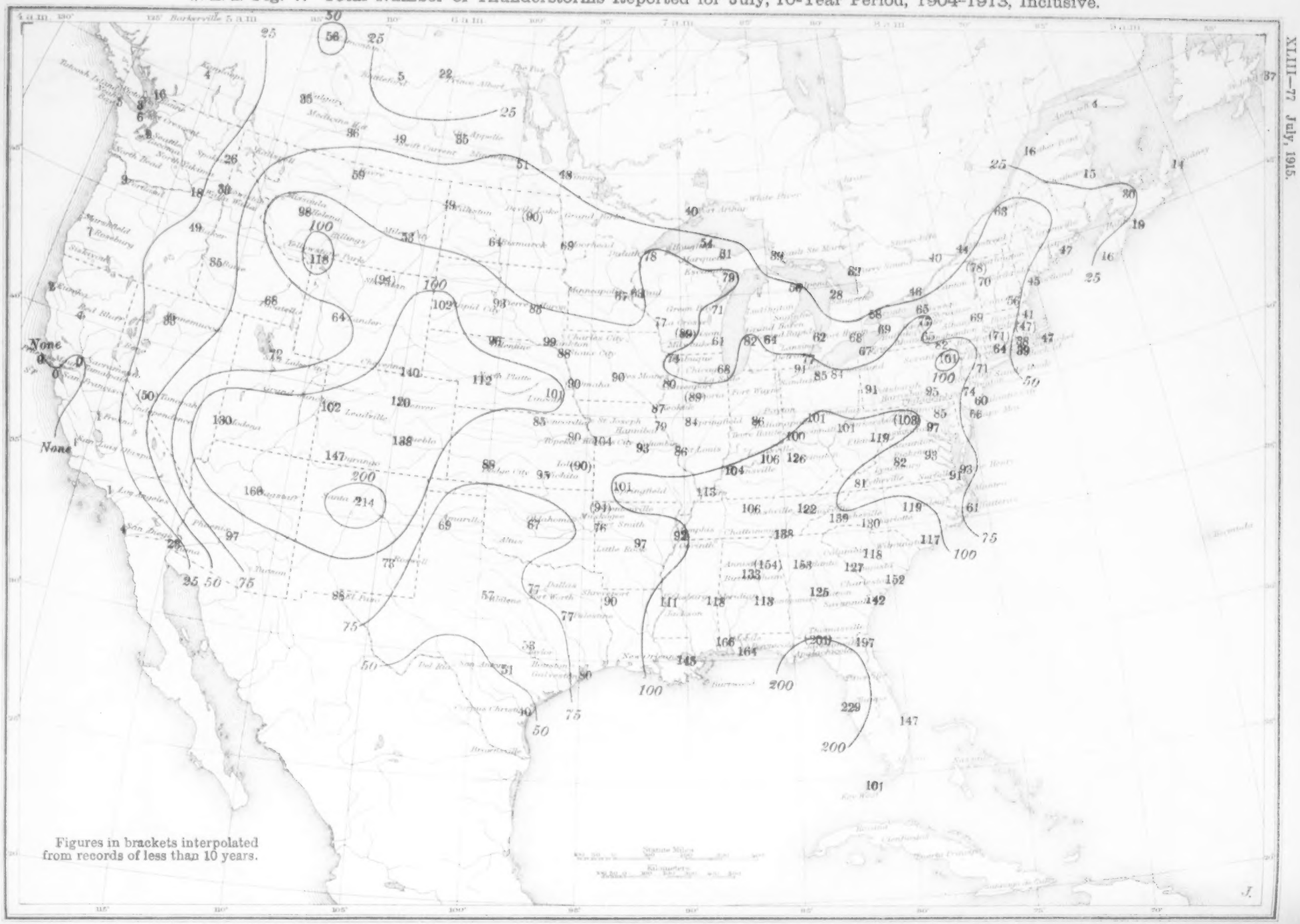


W. H. A. Fig. 6. Total Number of Thunderstorms Reported for June, 10-Year Period, 1904–1913, Inclusive.

W. H. A. **Fig. 6. Total Number of Thunderstorms Reported for June, 10-Year Period, 1904–1913, Inclusive.**

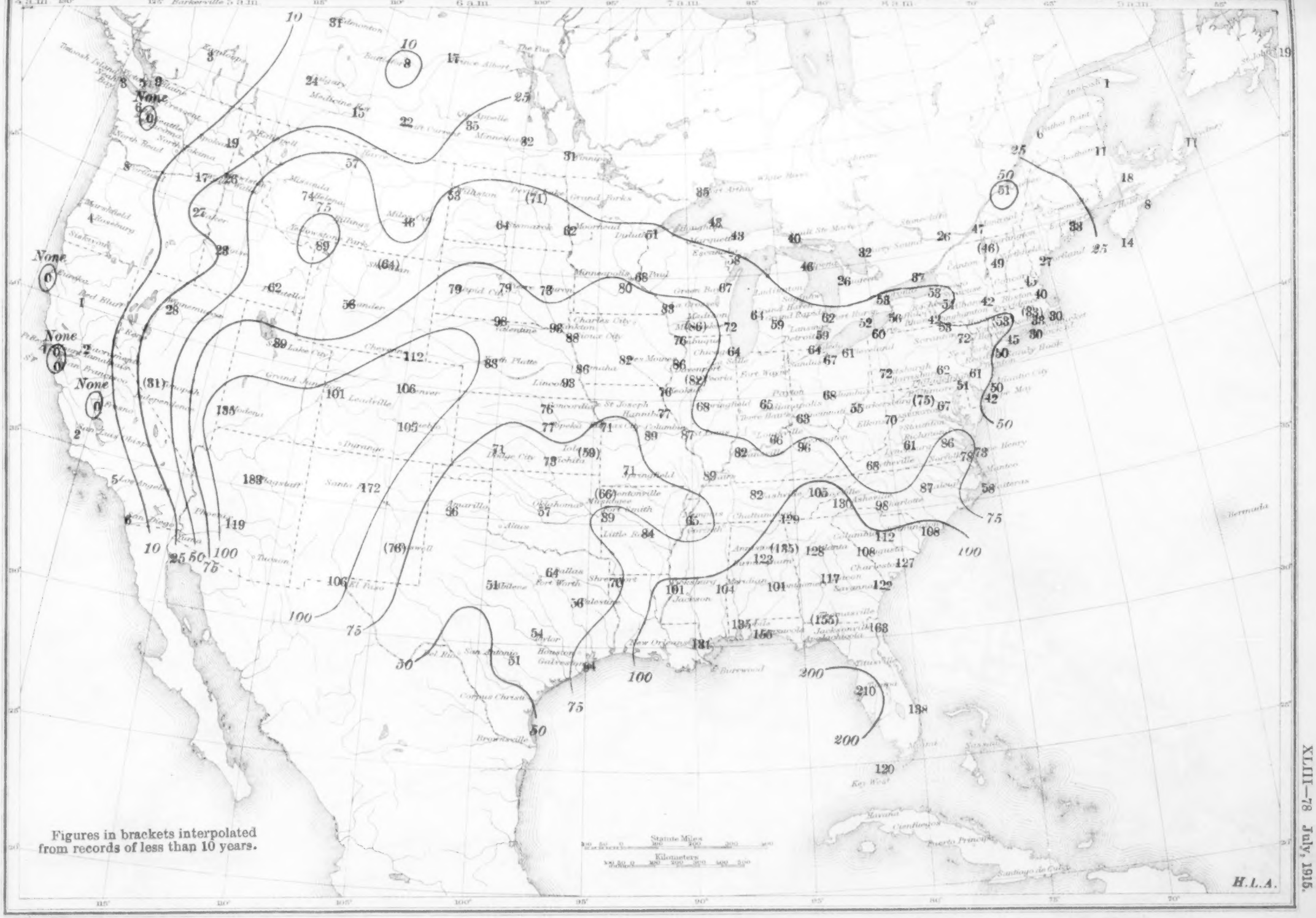


W. H. A. Fig. 7. Total Number of Thunderstorms Reported for July, 10-Year Period, 1904–1913, Inclusive.

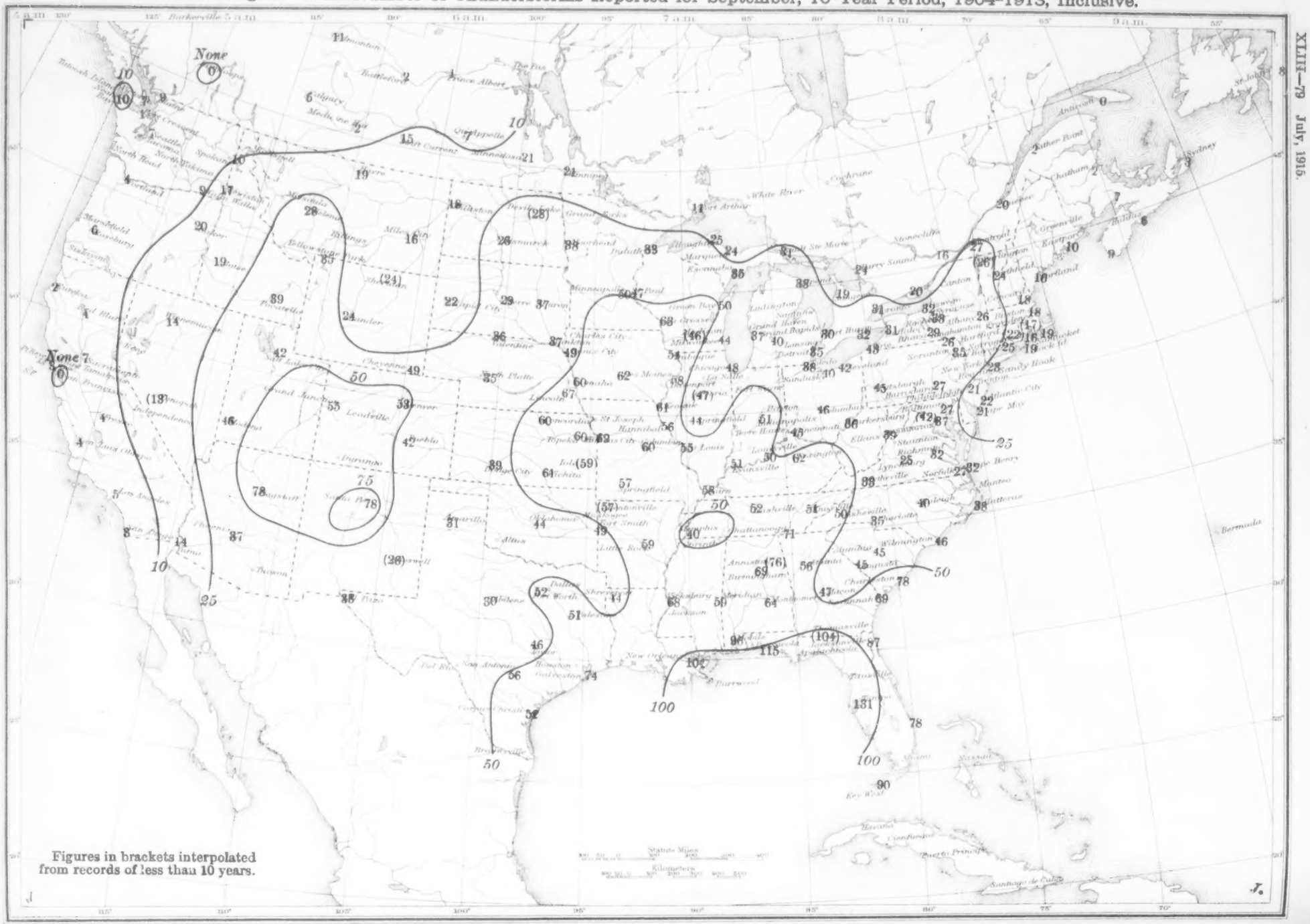


W. H. A. Fig. 8. Total Number of Thunderstorms Reported for August, 10-Year Period, 1904–1913, Inclusive.

W. H. A. **Fig. 8. Total Number of Thunderstorms Reported for August, 10-Year Period, 1904-1913, Inclusive.**

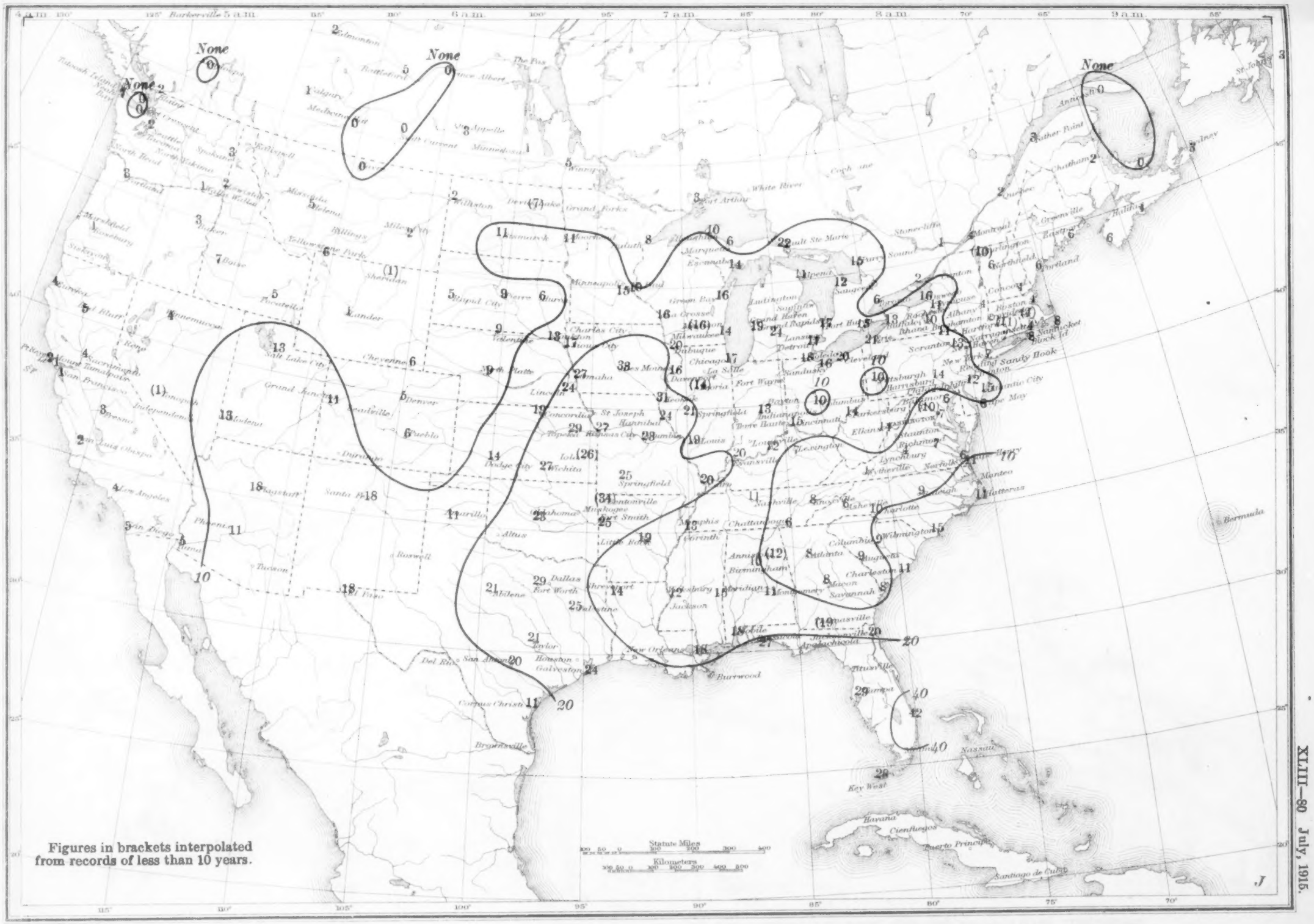


W. H. A. Fig. 9. Total Number of Thunderstorms Reported for September, 10-Year Period, 1904-1913, Inclusive.

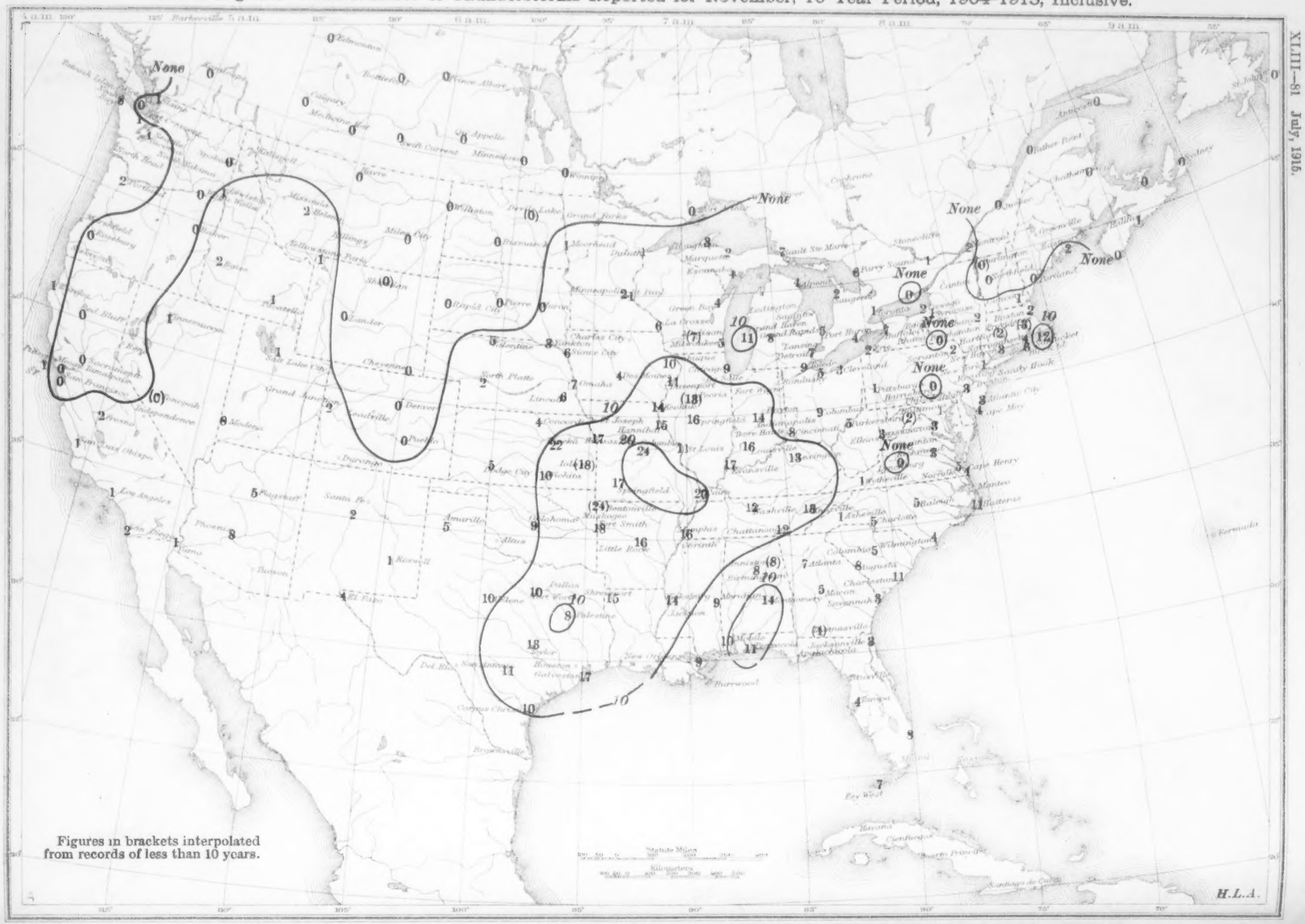


W. H. A. Fig. 10. Total Number of Thunderstorms Reported for October, 10-Year Period, 1904-1913, Inclusive.

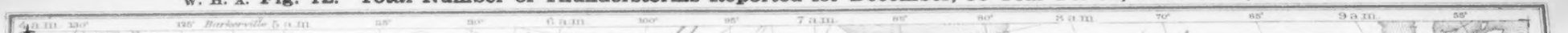
W. H. A. **Fig. 10. Total Number of Thunderstorms Reported for October, 10-Year Period, 1904-1913, Inclusive.**



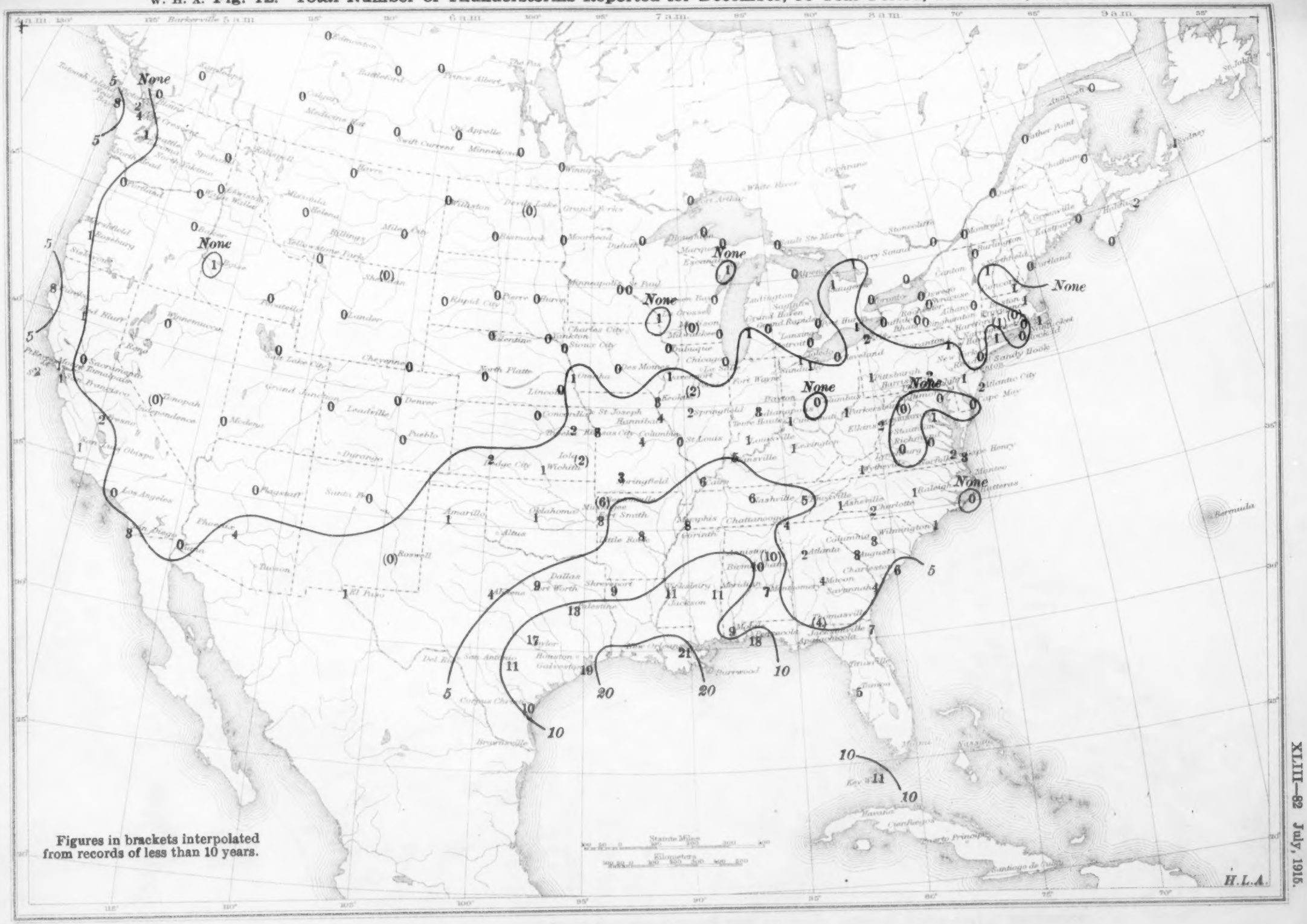
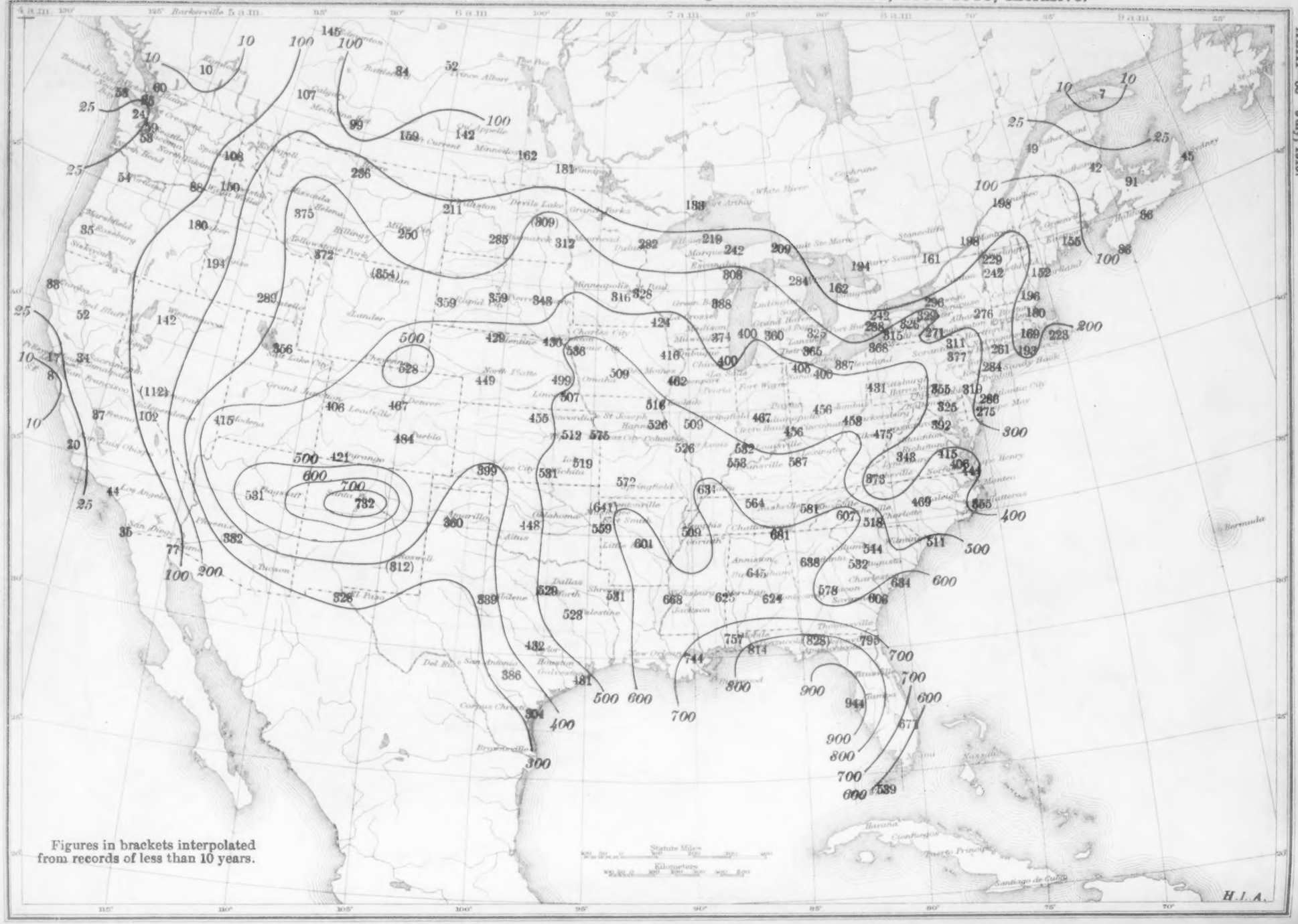
W. H. A. **Fig. 11. Total Number of Thunderstorms Reported for November, 10-Year Period, 1904–1913, Inclusive.**



W. H. A. **Fig. 12. Total Number of Thunderstorms Reported for December, 10-Year Period, 1904–1913, Inclusive.**



W. H. A. **Fig. 12. Total Number of Thunderstorms Reported for December, 10-Year Period, 1904–1913, Inclusive.**



W. H. A. **Fig. 13. Total Number of Thunderstorms During the 10-Year Period, 1904–1913, Inclusive.**